APPENDIX E

ECOLOGICAL RESOURCE SURVEY REPORTS AND SUMMARIES

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E. ECOLOGICAL RESOURCE SURVEY REPORTS AND SUMMARIES

The reports contained in this appendix provide additional details on the existing environment at the proposed sites for the SNS at Oak Ridge National Laboratory, Los Alamos National Laboratory, and Brookhaven National Laboratory. The preparers of this FEIS sent a detailed request for information to each of the sites. As part of this request, each site was directed to conduct a surveillance level survey for federal- and state-protected species, wetlands, and cultural resources at the proposed SNS site. The results of these surveys, as well as information specific to each of the proposed sites, are presented in these reports.

No report from Argonne National Laboratory is included in this appendix. The information received from this laboratory was not in a format that could easily be included in the appendix. All of the pertinent information has been included in Chapter 4 of the FEIS.

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ECOLOGICAL RESOURCE SURVEYS FOR THE PROPOSED NATIONAL SPALLATION NEUTRON SOURCE SITE ON THE OAK RIDGE RESERVATION:

1. POTENTIAL HABITAT FOR FEDERAL AND STATE LISTED ANIMAL AND PLANT SPECIES
2. JURISDICTIONAL WETLANDS

22 April 1997

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In Response to:
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1.0 INTRODUCTION

Ecological resource surveys were conducted on and adjacent to the proposed site of the National Spallation Neutron Source (NSNS) on the Oak Ridge Reservation (ORR), Oak Ridge, Tennessee, by the staff of JAYCOR Environmental in March, August, and September, 1997. The ORR is managed by Lockheed Martin Energy Systems, Inc. for the U.S. Department of Energy (DOE). The site includes approximately 290 acres (117 ha) along Chestnut Ridge and is located in Roane and Anderson Counties in the Ridge and Valley Province of Tennessee.

The ecological surveys performed were:

1. Reconnaissance surveys for potential habitat of state- and/or federally-listed plant and animal species, and;

2. A survey for jurisdictional wetlands.

2.0 THREATENED AND ENDANGERED (T&E) SPECIES

2.1 INTRODUCTION

The objectives of the plant and animal surveys were to determine the vegetation communities and types of habitat that exist on the proposed site for the NSNS and adjacent land, and to report potential habitat for state and federally protected terrestrial and aquatic species.

The federal Endangered Species Act of 1973 (ESA) requires that DOE consider the impacts of its actions on plant and animal species which are listed by the U.S. Fish and Wildlife Service (FWS) as threatened or endangered and on areas designated or proposed for designation as critical habitat. The FWS recommends that federal agencies also consider species that are candidates for listing during environmental planning since candidate species may eventually be listed. The National Environmental Policy Act also requires that federally-funded projects avoid or mitigate impacts to listed species.

Plant species listed by the Tennessee Department of Environment and Conservation are also provided limited protection by the Tennessee Rare Plant Protection and Conservation Act of 1985. This act protects listed plant species from removal or destruction without the consent of the landowner. DOE supports the protection of state-listed species on the ORR.

The Tennessee Wildlife Resources Agency lists fish and wildlife species which are threatened, endangered or in need-of-management in Tennessee. These species are protected by state laws and the knowing destruction of these animals and their habitat are prohibited.

For many protected species, the presence or absence of potential habitat can be easily determined. Other protected species, however, may not have overly strict or narrow habitat requirements or may use more than one habitat type and these species present a more challenging task when trying to identify potential habitat. In addition to this uncertainty is the fact that species do not always occur where there is suitable habitat. Thus, even though we have listed those species for which there appears to be suitable habitat on the site, the actual presence or absence of these species should be verified through systematic surveys prior to site development activities. Surveys for threatened and endangered species should be conducted during the proper sampling season to increase the probability of documenting species present.

2.2 T&E FISH AND WILDLIFE HABITAT EVALUATION METHODOLOGY

Existing data, aerial photos, forestry compartment maps and other information were reviewed to identify areas of potential habitat for state and federally protected (T&E) species. Field surveys were conducted during early

September to identify habitats present and to consider areas as potential habitat for protected species. Surveys included the areas to be developed, access roads, corridors, streams, and property adjacent to the site.

After reviewing information on the site and conducting field surveys, potential habitat for state and federal species was delineated. Species considered were those with previous records on the ORR (Mitchell et al. 1996) and those species with distribution ranges that include the ORR. Habitats were divided into categories and species known to occur in these habitats were considered as potentially occurring on the site.

2.3 T&E FISH AND WILDLIFE RESULTS

The major habitat types on the site are upland forest and pine forest. Upland forest encompasses those areas with mixed deciduous trees located on well-drained sites. It has at least three strataX canopy, and understory or shrub layer, and ground cover. Canopy trees include tulip poplar (*Liriodendron tulipifera*), chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), hickories (*Carya* spp.), and American beech (*Fagus grandifolia*) in varying combinations depending on slope and aspect. The understory and shrub layer contains sapling and pole sized trees of the canopy species, and flowering dogwood (*Cornus florida*). The ground cover consists of seedlings of canopy and understory species, ferns, and various herbaceous plants.

The pine forest habitat is composed of almost pure pine stands. The most predominant stands are those of planted loblolly pines (*Pinus taeda*). The trees are in rows, the canopy is closed, the substrate consists almost entirely of a thick mat of pine needles, and there is scarce understory, shrub layer, or ground cover vegetation. Small stands of white pine (*Pinus strobus*), shortleaf pine (*Pinus echinata*), and virginia pine (*Pinus virginiana*) were found on the site.

Other important habitat types exist on the area but represent a relatively small percentage of the total site area. These habitats include utility corridors, riparian forest, and wetland.

Important water resources were found on the site. Tributaries forming on the south side of the ridge and flowing into White Oak Creek may provide habitat for several species including the southeastern shrew, mole salamander and four-toed salamander. Seasonal pools and sinkholes have been documented on the site during current and previous surveys. Pools and sinkholes should be inventoried during late winter and early spring to verify presence or absence of T&E species.

Surveys were conducted for habitat of T&E fish. There appears to be no habitat suitable for those species which have been previously documented on the ORR or for other T&E fish known to occur in the region.
No suitable habitat was identified on or adjacent to the site for any federally listed T&E species. Suitable habitat was found for species listed as threatened or in-need-of-management by the State of Tennessee, or as federal species of concern. While in-need-of-management species are protected by state law, federal species of concern are not given formal protection by the Endangered Species Act. Nonetheless, it is wise to consider these species

during planning because they could be upgraded to threatened or endangered status in the future. If these species are eventually listed, it is important to consult with the FWS to determine impacts on these species. Systematic surveys of these potential habitat areas during the appropriate verification time-frames would be necessary to confirm the presence or absence of T&E species at specific locations on site.

Previous studies have provided some indication of which protected species may occur on the site (Mitchell et al. 1996). Table 2-1 provides a list of species which potentially occur on the site, their preferred habitat, and status. Suitable habitat was located for nine species listed by the State of Tennessee as in-need-of-management, one species listed as State Threatened, and one federally listed species of concern. Figure 2-1 illustrates the locations of potential habitat for each of these T&E species. Each T&E species with the potential to occur on the site is discussed below.

2.3.1 Sharp-shinned Hawk

The sharp-shinned hawk is considered an uncommon permanent resident on the ORR. This species may nest in woods bordered by open country and has been seen during the nesting season on the ORR (Mitchell et. al 1996). Powerline corridors on the site provide potential nesting habitat for this hawk. Summer records on the ORR were reported by Krumholz (1954) , Howell (1958), Hardy (1991), and Mitchell et al. (1996).

2.3.2 Cooper's Hawk

The Cooper's Hawk is also an uncommon permanent resident of the ORR. This species prefers mixed woodlands bordered by open country and has been observed during the nesting season in nearby areas. Powerline corridors on the site may provide suitable nesting habitat for this bird. Summer records were reported by Krumholz (1954) and Mitchell et al. (1996).

2.3.3 Cerulean Warbler

Although this bird is rare in the Ridge and Valley Province, it should be considered a possible nester in the area. There are no recent nesting records on the ORR. This bird prefers mature hardwood forests as is represented by some of the hardwood stands on Chestnut Ridge. Summer records were reported by Anderson and Shugart (1974) and Howell (1958). Mitchell et al. (1996) has reported spring and fall records for this species.

2.3.4 Grasshopper Sparrow

This species is an uncommon summer resident in the Ridge and Valley Province. This bird prefers areas of grassy fields and farmlands. Some areas along the powerline corridors within the NSNS boundary may provide suitable nesting habitat for this bird. Summer records have been reported on the ORR by Howell (1958) , Kroodsma (1987), and Mitchell et al. (1996).

Table 2-1. Protected vertebrate species with potential habitat on the NSNS site, their preferred habitats, and federal or state protection status.

Species	Habitat on NSNS and Status	Preferred Habitat
Sharp-shinned hawk (*Accipter striatus*)	Power line corridors In Need-of-Management	Mixture of woods and open country
Cooper's hawk (*Accipiter cooperii*)	Powerline corridors In Need-of-Management	Mixed woods with openings
Cerulean Warbler (*Dendroica cerulea*)	Mature hardwood forest on ridgetop Federal Species of Concern	Mature hardwood forests
Grasshopper Sparrow (*Ammodramus savannarum*)	Powerline corridors In Need-of-Management	Grassy fields and farmlands
Yellow-bellied sapsucker (*Sphyrapicus varius*)	Possible in most areas except pine stands In Need-of-Management	Open deciduous woods
Rafinesque's big-eared bat (*Plecotus rafinesquii*)	Abandoned building along C-17 Road In Need-of-Management	Unoccupied man-made structures and caves
Southeastern shrew (*Sorex longirostris*)	Pine plantations and tributaries In Need-of-Management	Pine woods and stream banks
Northern Pine Snake (*Pituophis m. melanoleucus*)	Ridgetops and powerline corridors State Threatened	Pine woods, dry ridges, and old fields
Eastern Slender Glass Lizard (*Ophisaurus attenuatus longicaudus*)	Ridgetops and powerline corridors In Need-of-Management	Dry upland areas, brushy cut-over woodlands
Mole salamander (*Ambystoma talpoideum*)	Depression with temporary pools In Need-of-Management	Moist low-lying woodland areas with ponds
Four-toed salamander (*Hemidactylium scutatum*)	Tributaries of White Oak Creek In Need-of-Management	Hardwood forest wetlands

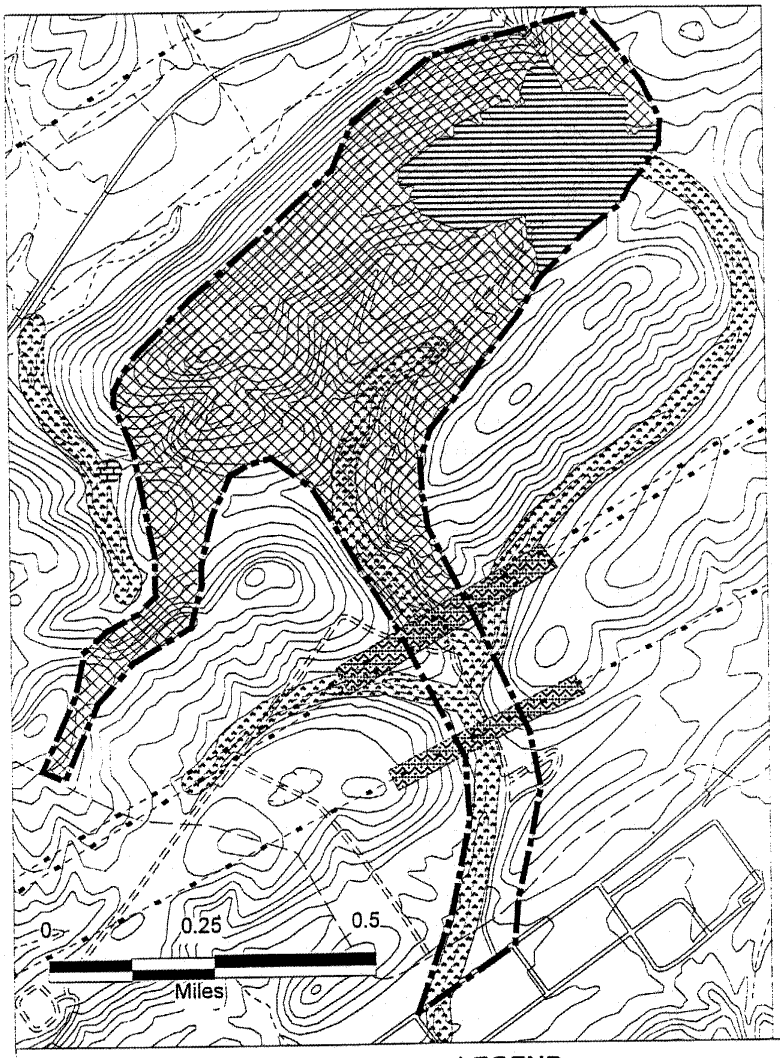

Fig.2-1. Potential habitat areas for T&E animal species within the proposed NSNS site.

Base Data:
ORNL Shared Data Initiative (SDI)

Map Composition:
September, 1997
D.Awl
JAYCOR Environmental

2.3.5 Yellow-bellied Sapsucker

This bird prefers open deciduous woods and is a common winter resident on the ORR. Suitable habitat for this species can be found throughout the site with the exception of pine woods. This species has been reported on the ORR previously by Krumholz (1954), Hardy (1991), and Mitchell et al. (1996).

2.3.6 Rafinesque's Big-eared Bat

There are no current records for the big-eared bat on the ORR, however, the Reservation has not been thoroughly surveyed for bats. This bat prefers unoccupied man-made structures and caves for roosting. A old homesite is located on the C-17 road along the western boundary of the site. Although the building is not structurally intact, it does provide potential habitat for bats.

2.3.7 Southeastern Shrew

The southeastern shrew was found in many locations across the ORR by Mitchell et al. (1996). This shrew has been found in a variety of habitat types and may occur along spring branches or tributaries and along White Oak Creek on the site. Previous records for this species on the ORR were documented by Dunaway and Kaye (1961), Howell and Dunaway (1958), Smith (1976) and Mitchell et al. (1996).

2.3.8 Northern Pine Snake

The pine snake prefers sandy pine woods, dry mountain ridges and old field habitats. This species has not been documented on the ORR in recent years. However, records are difficult to obtain because of the burrowing nature of this animal. The Chestnut Ridge area along the ridge top and powerline right-of-way may provide suitable habitat for this species. This snake was documented on the ORR by Krumholz (1954).

2.3.9 Eastern Slender Glass Lizard

Currently their are no documented records for this species on the ORR. This species prefers dry upland areas and brushy cut-over woodland. The distribution range for this species includes the NSNS site and there may be suitable habitat for this species along the ridges and powerline corridors.

2.3.10 Mole Salamander

The mole salamander prefers areas of moist low-lying woodlands or wetland habitats. This species may occur on the NSNS site if the sinkhole and low-lying areas form semi-permanent pools in the winter months. This salamander has not been previously documented on the ORR.

2.3.11 Four-toed Salamander

This salamander prefers areas of hardwood forest wetland associated with sphagnum moss. However, this amphibian has been documented on the ORR in wet areas where sphagnum moss was not present (Mitchell et al.1996). This species may occur near tributary streams and along White Oak Creek.

2.4 T&E PLANT HABITAT EVALUATION METHODOLOGY

Most of the proposed NSNS site had not previously been surveyed for T&E plants, defined here as vascular plant species listed for protection by the Federal or the Tennessee State Government (Awl et al. 1996). On-site exploratory level surveys for potential T&E plant habitat at the proposed NSNS site were conducted March 11, 1997, by Deborah Awl, and August 28 and September 11 and 15, 1997, by Larry Pounds.

2.5 T&E PLANT RESULTS

The proposed NSNS site contains the following vegetation types and landscape elements associated with the occurrence of T&E plants on the ORR: deciduous forests, mixed deciduous and pine forests, over-mature/successional pine plantations, wetlands and stream bottoms, limestone outcrops, springs and seeps. The site encroaches on an Environmental Research Park designated Natural Area (NA52, Bear Creek Spring Area; Awl et al, 1996), and three TNC Preliminary Conservation Sites* (BSR2-10, BSR3-16, and Landscape Complex 1; TNC, 1995). Additionally, the forest area on the south-east facing slope of Chestnut Ridge drains toward ecologically sensitive streams and wetlands in NA55 (Chestnut Ridge Springs Area), ARA6 (Upper White Oak Creek), BSR3-22, and BSR4-3. This forest provides significant landscape connectivity between NA52 and NA55. Parts of this forest may be incorporated into NA55 due to its hydrologic relationship and the recently verified presence of T&E plants.

Ten T&E plant species were recognized as potentially occurring within the proposed NSNS site (Table 2-2). Two T&E plant speciesXPink ladys-slipper [*Cypripedium acaule*] and American ginseng [*Panax quinquifolius*]Xwere verified in three locations on site during this survey (fig.2-2). An additional species verified on site during previous surveys, *Carex howei*, was removed from protection status by the State of Tennessee in 1997. Of the remaining species potentially occurring on the site, two are classified as having high potential for occurrence, while the remaining six are classified as having low potential for occurrence. Systematic surveys of these potential habitat areas during the specified verification time-frames would be necessary to confirm the presence or absence of T&E species at specific locations on site.

Table 2-2. T&E plant species potentially occurring within the proposed NSNS site.

Species	Common name	Habitat on ORR	Status*	Verification Time Frame	Potential for Occurrence Within the Proposed NSNS Site
Cypripedium acaule	Pink lady's-slipper	Dry to rich woods	E-CE	Apr.-July	Verified on site
Delphinum exaltatum	Tall larkspur	Barrens and woods	(C2), E	Aug.-Sept.	High
Fothergilla major	Mountain witchalder	Woods	T	Apr.-May	Low
Hydrastis canadensis	Golden seal	Rich woods	S-CE	April-July	Low
Juglans cinerea	Butternut	Slope near stream	(C2), T	no time frame	Low
Lilium canadense	Canada lily	Moist woods	T	June-July	High
Liparis loeselii	Fen orchis	Forested wetland	E	May-July	Low
Panax quinquifolius	Ginseng	Rich woods	S-CE	May-Oct.	Verified on site
Platanthera flava var. herbiola	Tuberculed rein-orchid	Forested wetland	T	May-Aug.	Low
Platanthera peramoena	Purple fringeless orchid	Wet meadow	T	July-Aug.	Low

*Status based on 1997 TN State List:

(C2) Special Concern, was listed under the formerly used C2 candidate designation. More information needed to determine status.
E Endangered in Tennessee.
T Threatened in Tennessee.
S Special Concern in Tennessee.
-CE Status due to commercial exploitation.

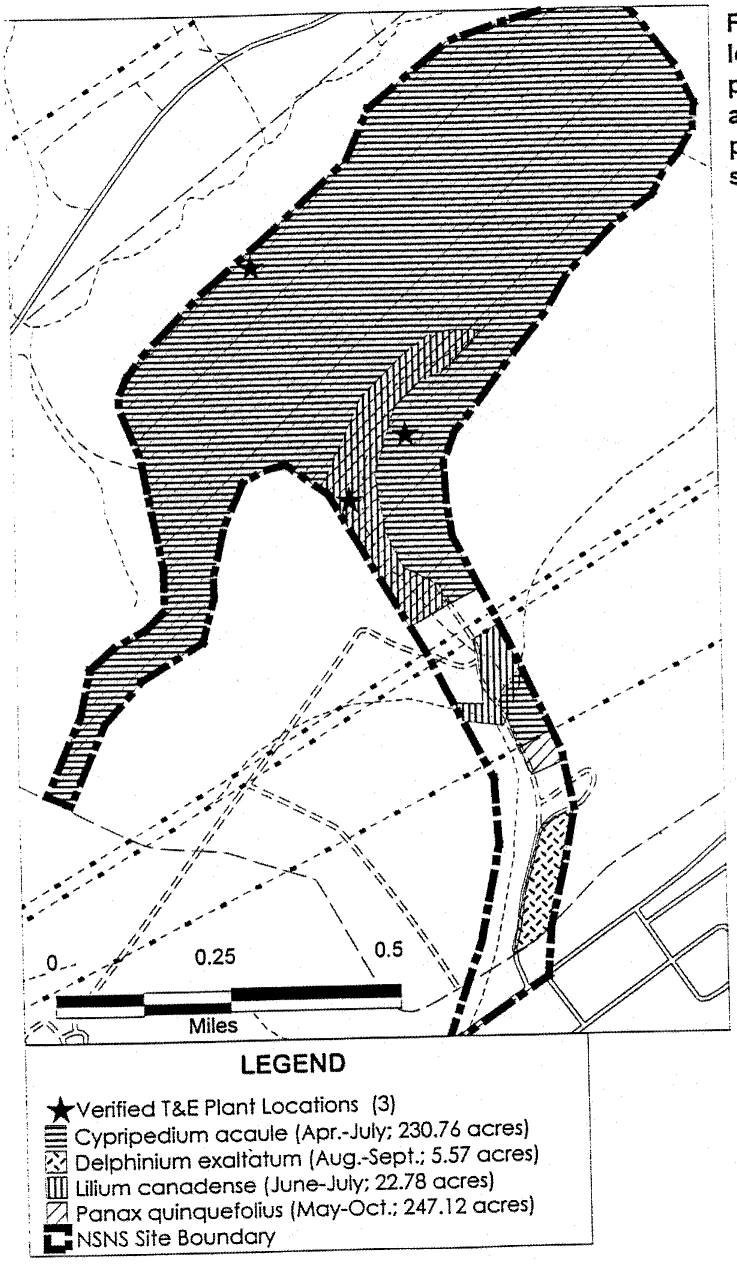

Fig. 2-2. T&E Plant locations and potential habitat areas within the proposed NSNS site.

3.0 WETLAND SURVEY

Executive Order 11990, Protection of Wetlands dated May 24, 1977 requires federal agencies to avoid, to the extent possible, adverse impacts associated with the destruction and modification of wetlands and to avoid direct and indirect support of wetlands development wherever there is a practicable alternative. In accordance with U. S. Department of Energy (DOE) Regulations for Compliance with Floodplains/Wetlands Environmental Review Requirements (Subpart B, 10 CFR 1022.11), a survey was conducted in September 1997 to identify wetlands on the proposed site for the National Spallation Neutron Source (NSNS) on the Oak Ridge Reservation, Oak Ridge, Tennessee.

3.1 WETLAND IDENTIFICATION METHODOLOGY

3.1.1 The U. S. Army Corps of Engineers Wetland Delineation Methodology

As required by the Energy and Water Development Appropriations Act of 1992, wetlands are identified using the criteria and methods set forth in the Wetlands Delineation Manual [U.S. Army Corps of Engineers (USACE) 1987]. USACE defines wetlands as: "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

The USACE lists three characteristics that are diagnostic of wetlands: (1.) The vegetation is characterized by a prevalence of macrophytes typically adapted to wetland soil and hydrological conditions; (2) the substrate is undrained hydric soil; and (3) the area is inundated either permanently or periodically at depths less than 2 m (6.6 ft.), or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

3.1.1.1 Hydrophytic vegetation

USACE (1987) defines hydrophytic vegetation as “the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present.” The U.S. Fish and Wildlife Service (Reed 1988) has developed a classification system that assigns species to wetland indicator classes according to the frequency with which a species occurs in a wetland (Table 3-1). If more than 50% of the vegetation in each strata (i.e., canopy, sapling/shrub, vines, herbaceous) have an indicator status of obligate (OBL), facultative wetland (FACW), and/or facultative (FAC), the vegetation is classified as hydrophytic. A positive (+) or negative (-) sign following any of the facultative indicator categories indicates, respectively, a frequency toward the higher end of the category (more frequently found in wetlands) or the lower end of the category (less frequently found in wetlands).

Table 3-1. Plant indicator classifications and frequency of occurrence in wetlands.

Classification	Occurrence in Wetlands(%)

Obligate Wetland	> 99
Facultative Wetland	67B99
Facultative	34B66
Facultative Upland	1B33
Upland	< 1

Source: P. B. Reed. 1988. National List of Plant Species That Occur in Wetlands: Tennessee. USFWS Biological Report NERC-88/18.42. U.S. Fish and Wildlife Service, Washington, D.C.

3.1.1.2 Hydric soils

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in a major part of the root zone. The following indicators are used to determine whether a given nonsandy soil meets the definition and criteria for hydric soils: The presence of organic soils, sulfidic material, aquic or peraquic moisture regime, iron and manganese concretions, and/or gleyed soil or a soil with a low chroma color and mottles.

Munsell Soil Color Charts (Kollmorgen Instrument Corp. 1992) are used to determine soil colors. The Munsell notation for color consists of separate notations for hue, value, and chroma. The hues are R (red), YR (yellow-red), and Y (yellow) and refer to the soil color in relation to the primary colors (red, yellow, and blue). The hues are further defined by the numbers 2.5, 5.0, 7.5, and 10 preceding the hue designation. The numbers indicate the gradation from red through yellow within each hue, with 2.5 being more red and 10 being more yellow. The value notation refers to the lightness of the hue, and ranges from 0 (absolute black) to 10 (absolute white). Chroma refers to the strength, or saturation, of the color, and ranges from 0 (neutral gray) to 8. In writing Munsell color notations, the sequence is always hue, value, and chroma. For instance, 10YR 5/2 indicates a soil on the yellow end of the yellow-red hue, with a value of 5 (mid-range) and a chroma of 2. Each Munsell notation corresponds to a color. For example, 10YR 5/2 is grayish-brown. Mineral hydric soils have one of the following features in the horizon immediately below the A-horizon, or between 0 and 25.6 cm (10 in.), whichever is shallower: 1) a matrix chroma of 2 or less in mottled soils or 2) a matrix chroma of 1 or less in unmottled soils.

3.1.1.3 Wetland hydrology

Of the three technical criteria, wetland hydrology is generally the least exact. Field indicators are useful for confirming wetland presence but are unreliable for delineating precise wetland boundaries. Indicators of wetland hydrology include recorded data (e.g., aerial photographs, soil surveys, floodplain delineations) and field evidence such as drainage patterns (surface scouring, absence of leaf litter, eroded soil, and drift lines), sediment deposition, watermarks, visual observation of either inundation or saturated soils or both, and oxidized rhizospheres.

3.2 WETLAND CLASSIFICATION

The wetlands identified in this survey were classified according to the system developed by Cowardin et al.

(1979) for wetland and deepwater habitats of the United States. This hierarchical system describes wetlands and deepwater habitats by system, class, and subclass. Additional modifiers are added for water regime, chemistry, soil, and disturbances. The systems are marine, estuarine, riverine, lacustrine, and palustrine. The marine and estuarine systems are oceanic and coastal and thus do not occur on ORR. The lacustrine and riverine systems encompass freshwater lakes and rivers/streams respectively. The palustrine system includes nontidal wetlands dominated by trees, shrubs, persistent emergents, and/or emergent mosses or lichens and includes vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and pond.

The palustrine system includes five classes which are vegetated, and are thus considered as wetlands under the USACE definition (1987): (1) aquatic bed (dominated by submerged or floating plants), (2) mossBlichen, (3) emergent (dominated by herbaceous plants that rise above the water surface), (4) scrubBshrub (dominated by shrubs and saplings), and (5) forested. Subclasses of the vegetated classes indicate differences in vegetative form, such as broad-leaved or needle-leaved, deciduous or evergreen, and persistent (species that normally remain standing at least until the beginning of the next growing season) or nonpersistent (plants that fall to the surface of the substrate or below the surface of the water at the end of the growing season). Water regime modifiers include temporarily flooded (A); saturated (B); seasonally flooded (C); semi-permanently flooded (F), and permanently flooded (H).

3.3 FIELD SURVEY

Existing maps, reports, and other information sources were consulted to determine potential and known wetland locations (i.e., stream bottoms, floodplains, topographic depressions, other surface water features). The potential and known wetland locations were field surveyed on between September 5 and 18, 1997 by Barbara Rosensteel. The survey areas were:

1.) White Oak Creek bottomland from Bethel Valley Road to the head of the stream;
2.) White Oak Creek north tributary 2 (WONT2) from White Oak Creek to the site boundary;
3.) White Oak Creek north tributary 1 (WONT1): The entire stream bottom and subdrainages;
4.) Bear Creek south tributary 2 (BCST2): The stream bottom from Bear Creek Road to the head of the stream.

The wetland boundaries identified during this survey were not physically marked (i.e., with flagging or stakes) in the field and were not located by engineering (e.g., civil) survey or other ground location method (i.e., Global Positioning System). Therefore, the wetland boundaries are approximate and the areal sizes are estimates. The accuracy of the size estimates is limited by the large scale and 20-foot elevation contours of the site map available for wetland mapping.

3.4 FINDINGS AND DISCUSSION

3.4.1 Wetland Survey Findings

Eight wetland areas were identified in and near the boundary of the proposed NSNS site (Table 3-2). Five of the wetlands are in the White Oak Creek watershed and are fully or partially within the site boundary. Two wetland areas were identified in the upper reach of White Oak Creek upstream of the powerline ROW, which is outside of the site boundary. One wetland area is in the riparian zone of Bear Creek south tributary 4 which is downslope of the site boundary. The wetlands are shown in Figure 3-1. Data sheets which include vegetation, soils, and hydrology data for each of the wetlands are in Appendix 1.

Table 3-2. Jurisdictional wetlands identified on and adjacent to the proposed NSNS site.

Wetland	Watershed	Estimated Area (acres)	Wetland Class	Within the proposed site boundary
WOM14	White Oak Creek	0.03	PEM1	YES
WOM15	White Oak Creek	0.09	PEM1F	YES
WOM16	White Oak Creek	1.60	PFO1C	YES
WOM17	White Oak Creek	0.15	PFO1C	NO
WOM18	White Oak Creek	<0.03	PEM1C	NO
WONT1-1	White Oak Creek	2.7	PFO1C	YES
WONT2-1	White Oak Creek	<0.01	PEM1	YES
BCST2-1	Bear Creek	0.35	PFO1C/PEM1C	NO

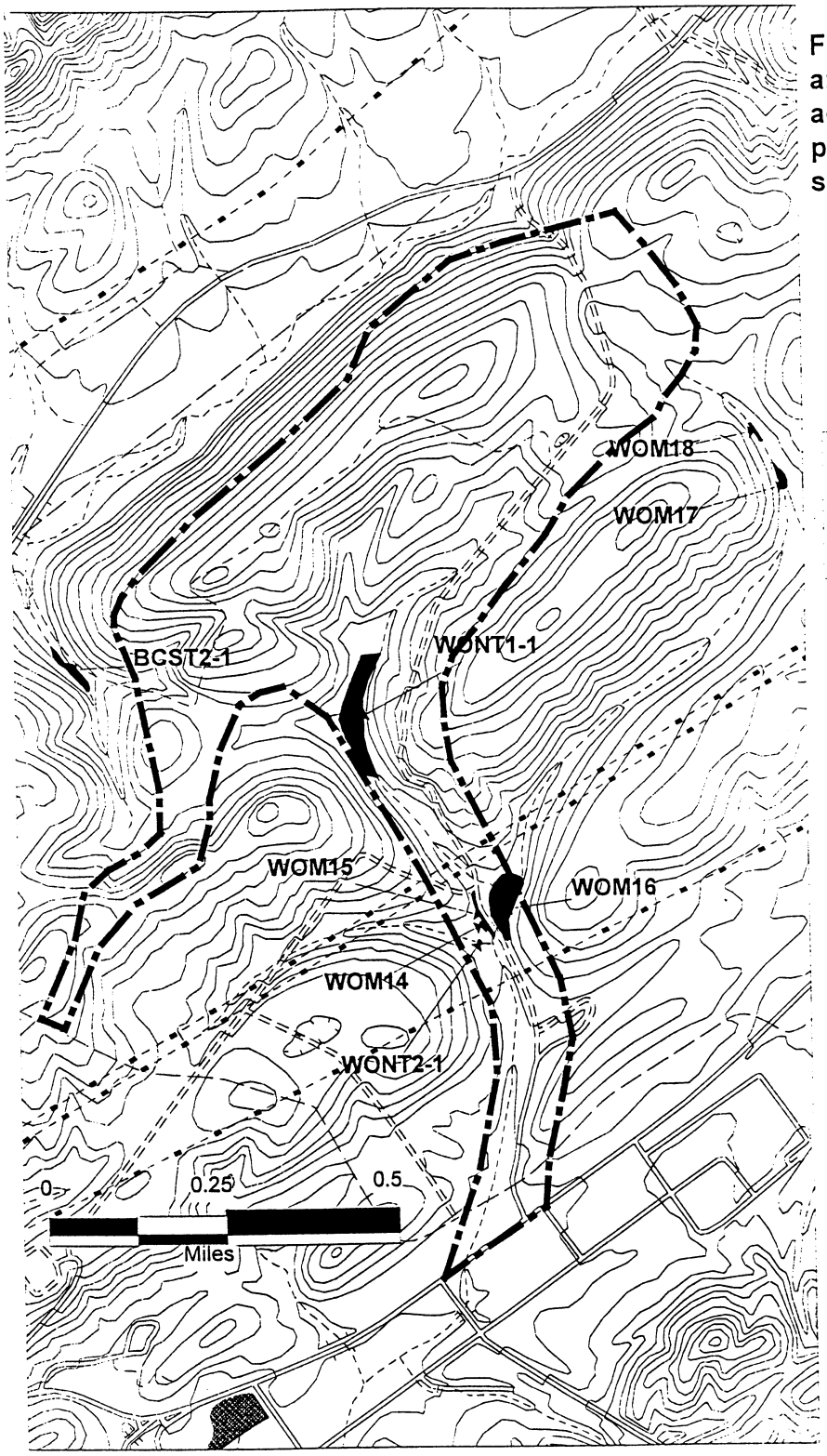

Fig.3-1. Wetland areas within and adjacent to the proposed NSNS site.

A small emergent wetland (WONT2-1) was identified along White Oak Creek north tributary 2. An old road, currently unused and overgrown, crosses the tributary near it's confluence with White Oak Creek. The emergent wetland has developed in a low spot in the road where it crosses the stream (although a culvert is present at the crossing). Surface runoff and seasonal flood waters collect in and flow through the wetland area. Species in the wetland include smartweed (*Polygonum* sp.; OBL or FACW), false nettle (*Boehmeria cylindrica*; FACW), microstegium (*Microstegium vimineum*; FAC+), and sedges (*Carex* spp.; OBL or FACW). This wetland area is estimated to be less than 0.01 acre in size and appears to be fully within the site boundary.

An emergent wetland swale (WOM15) is immediately adjacent to Chestnut Ridge Road near the White Oak Creek crossing. The swale begins at a spring. The spring discharge flows through a swale on the side of the road and empties into White Oak Creek. Shrubs such as alder (*Alnus serrulata*; FACW+) and elderberry (*Sambucus canadensis*; FACW-) are growing along one side of the swale. The swale is vegetated with numerous OBL and FACW species including watercress (*Nasturtium officinale*; OBL), great lobelia (*Lobelia siphilitica*; OBL), cardinal flower (*Lobelia cardinalis*; OBL), turtlehead (*Chelone glabra*; OBL), smartweed (*Polygonum* sp.; OBL or FACW), and sedges (*Carex* spp.; OBL). The estimated size of the wetland is less than 0.1 acre. It is fully within the site boundary.

An emergent wetland (WOM14) was identified in an isolated depression. The depression is adjacent to the wetland swale (WOM15), but is separated from it by a vegetated berm. The berm may have been made during road construction. The depression does not appear to have a surface outlet to the swale or to White Oak Creek. There was no water in the depression on the day of the survey, but it is likely that it holds precipitation and surface runoff during the winter and spring and during periods of rain in the summer. The soil had hydric characteristics. Species included a fescue (*Festuca arundinaceae*), false nettle (*Boehmeria cylindrica*; FACW), smartweed, Frank's sedge (*Carex frankii*; OBL), and other sedges. The estimated size of this wetland area is less than 0.03 acre. This wetland is fully within the site boundary.

A forested wetland (WOM16) was identified in a seep area along White Oak Creek immediately adjacent to the east side of Chestnut Ridge Road. This wetland area had initially been designated a Research Park Reference Area, but is now within Research Park Natural Area 55. *Carex leptalea* and *Bartonia paniculatum*, two species that are uncommon in east Tennessee, occur in this wetland. Dominant or common plant species in this wetland include sycamore (*Platanus occidentalis*; FACW-), red maple (*Acer rubrum*; FAC), green ash (*Fraxinus pennsylvanica*; FACW), spicebush (*Lindera benzoin*; FACW), microstegium, false nettle, cardinal flower, bugleweed (*Lycopus virginicus*; OBL), smartweed, and hog peanut (*Amphicarpa bracteata*; FAC). The estimated size of this wetland is 1.6 acres. Most or all of this wetland is within the site boundary.

A forested wetland (WOM17) and a small, fringe, emergent wetland (WOM18) were identified in the upper reach of White Oak Creek. The forested wetland occurs in a seep area that appears to contribute a significant portion of the baseflow of upper White Oak Creek during this time of year. The stream channel was dry upstream from the ROW for about half the length of this portion of the stream. Upstream of this dry reach, there was flowing water that was contributed by springs and seeps along this part of the stream bottom. The stream channel was

once again dry in the uppermost reach a short distance upstream of WOM18. Water levels in these headwater streams would be expected to be at or near their lowest level at this time of year. At other times of year, the entire stream channel would be expected to have flowing water.

The dominant vegetation species in WOM17 included sweetgum, red maple, ironwood, smartweed (*Polygonum punctatum*;), cardinal flower, microstegium, false nettle, and poison ivy (*Toxicodendron radicans*; FAC). The area was saturated and there was flowing water in surface channels. The approximate size of this wetland area is around 0.10 acre. This wetland is outside of the site boundary.

WOM18 consists of a narrow fringe (2' -3' wide) of emergent wetlands on the edge of the stream channel. This section of stream contained flowing water. Dominant species included microstegium, cardinal flower, smartweed, bugleweed, and sensitive fern (*Onoclea sensibilis*; FACW). The approximate size is less than 0.01 acre.

A forested wetland (WONT1-1) is located in the riparian zone of White Oak Creek north tributary 1 (WONT1). This tributary drainage is in Natural Area 55. The tributary is located in a forested drainage on the west side of Chestnut Ridge Road north of the powerline right-of-way (ROW). The stream crosses the powerline, flows through a culvert under Chestnut Ridge Road, and empties into White Oak Creek in the WOM16 wetland area south of the powerline ROW. The wetland is located along the middle reach of the stream. The size of the wetland area is roughly 2.5 acres. This wetland area is fully within the site boundary.

The primary water source for this wetland is groundwater in the form of perennial seeps and a seasonal high water table. Overbank flooding is a seasonal, but not a sustaining, source of water. Dominant species include sycamore, red maple, sweetgum (*Liquidambar styriciflua*; FAC), green ash, bugleweed, cardinal flower, and cinnamon fern (*Osmunda cinnamomea*; FACW). At a perennial seep which spread out over a wide area, the dominant species included smartweed, watercress, bugleweed, cutgrass (*Leersia oryzoides*; OBL), leathery rush (*Juncus coriaceous*; FACW), avens (*Geum* sp.; FACW- or FAC), and sticktights (*Bidens* sp.; OBL or FACW).

In the riparian zone of Bear Creek south tributary 4 are three small areas of forested wetlands and emergent wetlands at streamside seeps. These three areas are close together along the stream and were combined into one wetland area (BCST2-1) for purposes of mapping and description. The approximate size of the wetland area is 0.3 acre. It is downslope of, but not within, the site boundary. Dominant species include green ash, red maple, spicebush, microstegium, poison ivy, woodreed (*Cinna arundinacea*; FACW), and Virginia knotweed (*Tovara virginiana*; FAC).

3.4.2 Functional Assessment

The following section provides a brief description of the wetland functions that could be performed by the on-site wetlands. A qualitative assessment of these functions in the on-site wetlands was based on best professional judgement. A thorough wetland functional assessment is outside of the scope of the current work.

Wetland functions are physical, chemical, and biological processes or attributes of wetlands that are vital to the integrity of the wetland system (Adamus et al. 1991). Wetland functions include groundwater recharge and discharge, floodflow alteration, sediment stabilization, nutrient removal and transformation, sediment and toxicant retention, production export, and provision of wildlife and aquatic species habitat. Not all functions will be performed in every wetland. The factors that affect the performance of wetland functions are numerous and include geographic and topographic location; wetland position in the watershed; and physical, chemical, and biological characteristics of the wetland.

Wetland functions, as described by Adamus et al. (1991), include the following ones that could be present in headwater wetlands:

Floodflow Alteration - Floodflow alteration is the process by which peak flows from runoff, surface flow, groundwater interflow and discharge, and precipitation enter a wetland and are stored or delayed from their downstream movement. In order to provide effective storage, a wetland must not be filled to capacity with surface water. However, in developed watersheds, in the lower reaches of watersheds, and in watersheds with little wetland acreage, many wetlands become quickly saturated and filled to capacity (Adamus et al. 1991). The wetlands in the headwater areas on the site probably have limited influence on peak flows downstream because of their limited water storage capacity and small size in relation to the drainage area.

Nutrient Removal and Transformation - Nutrient removal and transformation includes the storage of nutrients (primarily macronutrients nitrogen and phosphorus) within the sediment or plant substrate, the transformation of inorganic nutrients to their organic forms, and the transformation and removal of nitrogen (Adamus et al. 1991).

The nitrogen and phosphorus loadings to the wetlands in undeveloped, forested headwater areas and other areas upstream of human activities would tend to be low; thus the opportunity for nutrient removal would be limited in the on-site wetlands. Nutrient transformation, such as denitrification of nitrogen introduced in groundwater and precipitation and conversion into organic forms, probably occurs to some degree in most of the wetlands on-site.

Sediment and Toxicant Retention - Sediment and toxicant retention is the process by which suspended solids and adsorbed contaminants are retained and deposited in a wetland. Toxicants can include heavy metals, radionuclides, pesticides, and other toxic organics (i.e., solvents and polychlorinated biphenyls). Toxicant retention is associated with sediment retention because many toxicants adsorb to solids and thus will be removed from the water column when the solids settle out. In the wetland, the toxicants can be permanently or temporarily sequestered in the sediments and in plant tissue, transferred to the atmosphere through volatilization, biochemically transformed to intermediate compounds that are less or more toxic than the parent compound, or completely mineralized to carbon dioxide and water. Sediments and associated toxicants can also be resuspended and exported from the wetland in subsequent flooding events (Adamus et al. 1991).

Because of their position in a relatively undisturbed forested headwater area, the opportunity for the sediment and toxicant reduction function to be expressed in the on-site wetlands is small. The value of this function, if it occurs, may be greatest in wetlands WOM16, WONT1-1, and BCST2-1 because of larger area and greater capacity (relative to the other on-site wetlands) for longer-term water retention and sediment settling.

Production Export - Production export refers to the flushing of organic material from the wetland to downstream or adjacent waters. Another mechanism of production export is insect emergence and consumption by vertebrates that travel out of the wetland.

The production export function may be a significant in the on-site wetlands and to the downstream aquatic system. Visual observations of the wetland and floodplain areas and the adjacent upland areas suggest that primary productivity in the shrub and herbaceous strata is greater in the wetlands, but it is not known if this translates into high production export from the sites.

Wildlife Diversity - Wildlife diversity is defined as the support of a notably great on-site diversity and abundance of wetland-dependent birds (Adamus et al. 1991). However, the focus on birds should not imply that other wildlife species, such as many furbearers (mink), other mammals (e.g., shrews), many amphibians, and some reptiles (e.g., bog turtles, water snakes), are any less important or dependent on wetlands. Therefore, wildlife diversity includes all wildlife species that are wetland-dependent or that may use wetlands on a daily, seasonal, or intermittent basis. Wildlife species present on the ORR that use wetlands include raccoons, mink, beaver, turtles, salamanders, frogs, and bird species such as the Louisiana waterthrush.

Functions provided by the wetlands found in and adjacent to the proposed NSNS site include the provision of wildlife habitat, including amphibian breeding habitat, nutrient transformation, and organic material production and export. These areas also provide plant species diversity by supporting numerous plant species that will only grow in saturated conditions. These species include great lobelia, cardinal flower, turtlehead, smartweeds, cinnamon fern, some species of orchids, and various sedges.

4.0 SUMMARY

Ecological resource surveys were conducted on the proposed site of the National Spallation Neutron Source (NSNS) on the Oak Ridge Reservation (ORR), Oak Ridge, Tennessee, by the staff of JAYCOR Environmental in March, August, and September 1997. Reconnaissance surveys for potential habitat of state- and/or federally-listed plant and animal species, and surveys for jurisdictional wetlands were conducted.

Suitable habitat was located for nine animal species listed by the State of Tennessee as in-need-of-management, one species listed as State Threatened, and one federally listed species of concern. There appears to be no habitat suitable for any fish species that have been previously documented on the ORR or for other T&E fish known to occur in the region.

The actual presence or absence of the species for which potential habitat was found should be verified through scientific surveys prior to site development activities. Surveys for threatened and endangered species should be conducted during the proper sampling season to increase the probability of documenting animals present.

On-site exploratory level surveys for potential T&E plant habitat at the proposed NSNS site were conducted in March, August, and September 1997. Ten T&E plant species were recognized as potentially occurring within the proposed NSNS site. Two T&E plant speciesXpink ladys-slipper [*Cypripedium acaule*] and American ginseng [*Panax quinquifolius*]X were verified on site during this survey. Systematic surveys of these potential habitat areas during the specified verification time-frames would be necessary to confirm the presence or absence of T&E species at specific locations on site.

The site encroaches on an Environmental Research Park designated Natural Area (NA52) and three TNC Preliminary Conservation Sites* (BSR2-10, BSR3-16, and Landscape Complex 1). The forest area on the south-east facing slope of Chestnut Ridge drains toward ecologically sensitive streams and wetlands in NA55 (Chestnut Ridge Springs Area), ARA6 (Upper White Oak Creek), BSR3-22, and BSR4-3.

A wetland survey was conducted in September 1997. Jurisdictional wetlands were identified following the U.S. Army Corps of Engineers criteria. A total of eight wetlands were identified in (5 wetlands) and adjacent to (three wetlands) the site. The estimated size of the wetlands ranges from <0.01 acre to 2.7 acres. The functions that are likely to be performed by the on-site wetlands include nutrient transformation, production and export of organic material, production of invertebrates, and wildlife habitat, as well as providing plant species diversity.

Within the site boundary, one forested wetland (WOM16), an emergent wetland in a spring-fed swale (WOM15), and a small emergent wetland area in an isolated depression (WOM14) are adjacent to Chestnut Ridge Road at the White Oak Creek crossing. A small emergent wetland (WONT2-1) is in a low elevation area in an old road bed that crosses White Oak Creek north tributary 2. A forested wetland (WONT1-1) is located in the middle reach of White Oak north tributary 1 which is in the drainage to the west of Chestnut Ridge Road. Outside of the site boundary, a forested wetland (WOM17) and a fringe, emergent wetland (WOM18) were identified in the upper reach of White Oak Creek. An area of forested wetland and emergent wetland at streamside seeps was identified in the bottomland of Bear Creek south tributary 2 outside of the site boundary.

5.0 REFERENCES

Adamus, P. R., E. J. Clairain, Jr., R. D. Smith, and R. E. Young. 1987. Wetland Evaluation Technique (WET). Vol. II: Methodology. Operational Draft AD-A189 968. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Adamus, P. R., L. T. Stockwell, E. J. Clairain, Jr., M. E. Morrow, L. P. Rozas, and R. D. Smith. 1991. Wetland Evaluation Technique (WET). Vol. 1: Literature Review and Evaluation Rationale. Wetland Research Program Technical Report WRP-DE-2. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Anderson, S. H. and H. H. Shugart, Jr. 1974. Habitat Selection of Breeding Birds in an East Tennessee Deciduous Forest. Ecology 55(4): 828-37.

Awl et al, 1996. Survey of Protected Vascular Plants on the Oak Ridge Reservation, Oak Ridge, Tennessee. ES/ER/TM-194.

Brinson, M. M. 1993. A Hydrogeomorphic Classification for Wetlands. Wetlands Research Program Technical Report WRP-DE-4. U.S. Army Corps of Engineers, Washington, DC.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

Dunaway, P. B. and S. V. Kaye. 1961. Studies of Small-Mammal Populations on the Radioactive White Oak Lake Bed. p. 167-85 In Trans. 26th N. Am. Wildl. Nat. Res. Conf., March 6-8, Wildlife Management Institute.

Hardy, C. L. 1991. A Comparison of Bird Communities in Loblolly vs. White Pine Plantations on the Oak Ridge National Environmental Research Park. Master's Thesis, The University of Tennessee.

Howell, J. C. 1958. Long-range Ecological Study of the Oak Ridge Area. I. Observations on the Summer Birds in Melton Valley. Oak Ridge National Laboratory. Oak Ridge, Tennessee.

Howell, J. C. and P. B. Dunaway. 1958. Long-term Ecological Study of the Oak Ridge Area. II. Observations on the Mammals with Special Reference to Melton Valley. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Kollmorgen Instrument Corp., MacBeth Division. 1992. Rev. ed. Munsell Soil Color Charts. Newburgh, N.Y.

Kroodsma, R. L. 1987. Resources Management Plan for the Oak Ridge Reservation, Volume 24: Threatened and Endangered Animal Species. ORNL/ESH-1/V24, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Krumholz, L. A. 1954. An Ecological Survey of White Oak Creek, 1950-53. Vol. 1. ORO-587, Atomic Energy Commission, Department of Health and Safety.

Mitchell, J. M., E. R. Vail, J. W. Webb, J. W. Evans, A. L. King, P. A. Hamlett. 1996. Survey of Protected Terrestrial Vertebrates on the Oak Ridge Reservation. Final Report. ES/ER/TM-188/R1. Oak Ridge National Laboratory. Oak Ridge, Tennessee. 35p.

Reed, P. B. 1988. National List of Plant Species That Occur in Wetlands: Tennessee. USFWS Biological Report NERC-88/18.42. U.S. Fish and Wildlife Service, Washington, D.C.

Smith, R. D. 1995. A Procedure for Assessing Wetland Functions Based on Functional Classification and Reference Wetlands. National Interagency Workshop on Wetlands: Technology Advances for Wetlands Science. New Orleans, La. Sponsored by U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Miss.

Smith, T. R. 1976. An Evaluation of Vertically Stratified Traps for Censusing Small Mammal Populations. Master's Thesis, The University of Tennessee.

TNC (The Nature Conservancy). 1995. Oak Ridge Reservation, biodiversity, and the Common Ground Process. Preliminary biodiversity report on the Oak Ridge Reservation.

U.S. Army Corps of Engineers (USACE). 1987. Wetlands Delineation Manual. Technical Report Y-87-1. Waterways Experiment Station, Vicksburg, Miss.

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APPENDIX 1:

WETLAND FIELD DATA SHEETS

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Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation			
State: TN **County: Roane / Anderson** **Date: 5 Sept 1997** **Wetland ID: WOM14** **Wetland Class: PEM1A** **Description: Emergent wetland in a depression in a prior disturbed area**			
VEGETATION **Dominant Species: Trees and shrubs**	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
None		*Festuca arundinacea* *Boehmeria cylindrica* *Carex frankii* *Eupatorium fistulosum* *Eupatorium coelestinum* Sedges	FAC- FACW OBL FAC+ FAC OBL, FACW, or FAC
% of species that are OBL, FACW, and/or FAC: 100 **Hydrophytic Vegetation: YES**			
SOILS **Matrix**	**Mottles**	**Texture/Other**	
10YR 5/1	7.5YR 4/6	sandy silt loam / mottles are few and faint	
Hydric Soils: YES **Basis: Matrix chroma and presence of mottles**			
HYDROLOGY **Inundated: NO** **Depth to standing water: None** **Saturated: YES** **Depth to saturated soil: Surface** **Other indicators: Patches of bare soil indicating ponded water**			
Wetland Hydrology: YES **Basis: Evidence of ponding; Moist soil following several weeks without significant rainfall**			
Atypical Situation: NO **Normal Circumstances: Possibly a manmade situation**			
Wetland Determination: **Wetland: YES** **Nonwetland**			
Comments: The depression in which the wetland occurs is separated from Chestnut Ridge Road and the wetland swale / spring by a vegetated berm that appears to be manmade. The depression does not have a surface outlet for water. Determined by: B. A. Rosensteel, PWS, JAYCOR			

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 5 Sept 1997**
Wetland ID: WOM15 **Wetland Class: PEM1F**
Description: Emergent wetland in a spring run channel along Chestnut Ridge Road

VEGETATION **Dominant Species:** **Trees and shrubs**	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
Alnus serrulata	FACW	*Nasturtium officinale*	OBL
Sambucus canadensis	FACW-	*Lobelia siphilitica*	OBL
		Chelone glabra	OBL
		Carex lurida	OBL
		Mentha piperita	FACW
		Carex vulpinoidea	OBL
		Polygonum sp.	OBL or FACW
		Eupatorium fistulosum	FAC+
		Vernonia sp.	Depends on species

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS **Matrix**	**Mottles**	**Texture/Other**
10YR 4/1		Stony, silty sand
10YR 5/1		Silty clay

Hydric Soils: YES
Basis: Matrix chroma

HYDROLOGY
Inundated: YES **Depth to standing water: 4" in boring on bank of swale**
Saturated: YES **Water in spring run channel was 2"+ deep**
Depth to saturated soil: At surface
Other indicators: Water was flowing through the swale from a perennial spring
Wetland Hydrology: YES

Atypical Situation: NO
Normal Circumstances: YES

Wetland Determination: **Wetland: YES** **Nonwetland**

Comments: This wetland should not be confused with a roadside runoff ditch, although it probably does carry storm runoff. The water source is a perennial spring.

Determined by: B. A. Rosensteel, PWS, JAYCOR

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation **State: TN** **County: Roane / Anderson** **Date: 5 Sept 1997** **Wetland ID: WOM16** **Wetland Class: PFO1C** **Description: Forested wetland along White Oak Creek on upstream side of Chestnut Ridge Road**			
VEGETATION **Dominant Species: Trees and shrubs**	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
Platanus occidentalis	FACW-	*Microstegium vimineum*	FAC+
Acer rubrum	FAC	*Boehmeria cylindrica*	FACW
Fraxinus pennsylvanica	FACW	*Lobelia cardinalis*	OBL
Alnus serrulata	FACW	*Lycopus virginicus*	OBL
		Polygonum sp.	OBL or FACW
		Leersia oryzoides	OBL
		Amphicarpa bracteata	FAC
		Juncus coriaceous	FACW
		Carex spp.	OBL or FACW
% of species that are OBL, FACW, and/or FAC: 100 **Hydrophytic Vegetation: YES**			
SOILS **Matrix**	**Mottles**	**Texture/Other**	
1.) 5/N	10YR 3/3	Stony, sandy silt loam - Saturated	
2.) 10YR 5/1		Gravelly silt loam - Dry	
3.) 10YR 5/1	7.5YR 4/6	Sandy silt loam - Saturated	
Hydric Soils: YES **Basis: Matrix chroma and mottles**			
HYDROLOGY **Inundated: NO** **Saturated: YES, except at outer edges** **Other indicators: Presence of seeps**		**Depth to standing water: 12-13"** **Depth to saturated soil: At surface except at the outer edges of the wetland.**	
Wetland Hydrology: YES			
Atypical Situation: NO **Normal Circumstances: YES**			
Wetland Determination:		**Wetland: YES**	**Nonwetland**
Comments: Determined by: B. A. Rosensteel, PWS, JAYCOR			

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 5 Sept 1997**
Wetland ID: WONT2-1
Wetland Class: PEM1
Description: Emergent wetland in an old road bed where the tributary stream crosses

VEGETATION **Dominant Species:** **Trees and shrubs**	**Indicator Status**	**Dominant Species:** **Herbaceous**	**Indicator Status**
None		*Microstegium vimineum*	FAC+
		Boehmeria cylindrica	FACW
		Polygonum sp.	OBL or FACW
		Geum sp.	FACW- or FAC
		Carex spp.	OBL or FACW

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS **Matrix**	**Mottles**	**Texture/Other**

Unable to obtain a soil sample with the hand-held soil auger because the substrate primarily consists of the former compacted, gravel roadbed.

Hydric Soils: Inconclusive
Basis:

HYDROLOGY
Inundated: NO **Depth to standing water:**
Saturated: YES **Depth to saturated soil:**
Other indicators: Surface flow channels

Wetland Hydrology: YES

Atypical Situation: YES.
Normal Circumstances:

Wetland Determination: **Wetland: YES** **Nonwetland**

Comments: If soil has hydric characteristics, it would not be an atypical situation because all three criteria would be met. The wetland may have developed as a result of past development.

Determined by: B. A. Rosensteel, PWS, JAYCOR

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 5 Sept 1997**
Wetland ID: WONT1-1 **Wetland Class: PFO1C**
Description: Forested wetland in an area of seeps. One seep area is dominated by herbaceous species

VEGETATION **Dominant Species:** **Trees and shrubs**	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
Liquidambar styriciflua	FAC+	*Microstegium vimineum*	FAC+
Acer rubrum	FAC	*Cinna arundinacea*	FACW
Alnus serrulata	FACW+	*Lobelia cardinalis*	OBL
Lindera benzoin	FACW	*Toxicodendron radicans*	FAC
		Nasturtium officinale	OBL
Herbaceous		*Juncus coriaceous*	FACW
Geum sp.	FACW- or FAC	*Lycopus virginicus*	OBL
Osmunda cinnamomea	FACW+	*Bidens* sp.	OBL, FACW or FAC
		Leersia oryzoides	OBL

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS **Matrix**	**Mottles**	**Texture/Other**
10YR 6/2	7.5YR 5/8	Silt loam

In flowing seep area, the substrate is a very stony, gravelly, sand. In one sample: 3" of an organic silty sand underlain by a gray silty sand with dark brown/ black organic streaking.

Hydric Soils: YES
Basis: Matrix chroma and mottles; Sandy layer with organic streaking; Inundation in seep areas

HYDROLOGY
Inundated: YES (in seep areas)
Saturated: YES (in seep areas)
Other indicators: surface flow features
Depth to standing water: Above surface in seep areas; no water in soil borings at upstream edges of wetland area
Depth to saturation: At surface in seep areas; soil is dry in some upstream and outer edges of wetland

Wetland Hydrology: YES

Atypical Situation:
Normal Circumstances: YES

Wetland Determination: **Wetland: YES** **Nonwetland**

Comments: The areas near the wetland margins and in upstream sections had soils with hydric characteristics, but there was no saturation of the soils on the day of the survey. This is not unexpected during the dry season when there had been no significant rainfall for several weeks.

Determined by: B. A. Rosensteel, PWS, JAYCOR

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 16 Sept 1997**
Wetland ID: BCST2-1 **Wetland Class: PFO1C; PEM1C**
Description: An area of forested wetland and small emergent wetlands at seeps

VEGETATION Dominant Species: Trees and shrubs	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
Fraxinus pennsylvanica	FACW	*Microstegium vimineum*	FAC+
Acer rubrum	FAC	*Lycopus virginicus*	OBL
Liquidambar styriciflua	FAC+	*Tovara virgininana*	FAC
Carpinus caroliniana	FAC	*Cinna arundinacea*	FACW
Lindera benzoin	FACW	*Cryptotaenia canadensis*	FAC+
		Lobelia cardinalis	OBL
		Toxicodendron radicans	FAC

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS Matrix	**Mottles**	**Texture/Other**
10YR 6/1	7.5YR 4/6 and 4/4	Silt loam / Manganese concretions

Hydric Soils: YES
Basis: Matrix chroma and mottles

HYDROLOGY
Inundated: In some areas **Depth to standing water: At or near surface near stream**
Saturated: Yes **channel; None in riparian zone.**
Other indicators: _____ **Depth to saturated soil: At surface** **_____**

Wetland Hydrology: YES

Atypical Situation:
Normal Circumstances: YES

Wetland Determination: **Wetland: YES** **Nonwetland**

Comments: Area subject to flooding. Parts of the wetland that occur on alluvial deposits in the stream were inundated on the day of the survey. The remainder of area was not inundated, but soils were saturated.

Determined by: B. A. Rosensteel, PWS, JAYCOR

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 18 Sept 1997**
Wetland ID: WOM17 **Wetland Class: PFO1C**
Description: A seep area in a forested riparian zone

VEGETATION **Dominant Species:** **Trees and shrubs**	**Indicator Status**	**Dominant Species: Herbaceous**	**Indicator Status**
Acer rubrum	FAC	*Microstegium vimineum*	FAC+
Liquidambar styriciflua	FAC+	*Lycopus virginicus*	OBL
Carpinus caroliniana	FAC	*Lobelia cardinalis*	OBL
		Toxicodendron radicans	FAC
		Polygonum sp.	OBL or FACW
		Boehmeria cylindrica	FACW

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS **Matrix**	**Mottles**	**Texture/Other**
10YR 5/1	7.5YR 4/6 and 4/4	Gravelly silt loam

Hydric Soils: YES
Basis: Matrix chroma and mottles

HYDROLOGY
Inundated: In some areas **Depth to standing water: not recorded**
Saturated: Yes **Depth to saturated soil: At surface**
Other indicators: _____

Wetland Hydrology: YES

Atypical Situation:
Normal Circumstances: YES

Wetland Determination:	**Wetland: YES**	**Nonwetland**

Comments: Area subject to flooding. Parts of the wetland that occur on alluvial deposits in the stream were inundated on the day of the survey. The remainder of area was not inundated, but soils were saturated.

Determined by: B. A. Rosensteel, PWS, JAYCOR

Wetland Delineation Data Sheet

Project site: Proposed site for National Spallation Neutron Source on the Oak Ridge Reservation
State: TN **County: Roane / Anderson** **Date: 18 Sept 1997**
Wetland ID: WOM18 **Wetland Class: PEM1C**
Description: Emergent wetland in a narrow band on edge of stream channel

VEGETATION **Dominant Species:** **Trees and shrubs**	**Indicator Status**	**Dominant Species:** **Herbaceous**	**Indicator Status**
None		*Microstegium vimineum*	FAC+
		Lycopus virginicus	OBL
		Lobelia cardinalis	OBL
		Onoclea sensibilis	FACW
		Boehmeria cylindrica	FACW

% of species that are OBL, FACW, and/or FAC: 100
Hydrophytic Vegetation: YES

SOILS **Matrix**	**Mottles**	**Texture/Other**
10YR 6/1	7.5YR 4/6 and 4/4	Gravelly silt loam

Hydric Soils: YES
Basis: Matrix chroma and mottles

HYDROLOGY
Inundated: No **Depth to standing water: Within a few inches of surface**
Saturated: Yes **Depth to saturated soil: At surface**
Other indicators:

Wetland Hydrology: YES

Atypical Situation:
Normal Circumstances: YES

Wetland Determination:	**Wetland: YES**	**Nonwetland**

Comments: Area subject to flooding. Parts of the wetland that occur on alluvial deposits in the stream were inundated on the day of the survey. The remainder of area was not inundated, but the soil was saturated.

Determined by: B. A. Rosensteel, PWS, JAYCOR

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Title: Spallation Neutron Source (SNS)
Alternate Siting Study
Preliminary Environmental Information Document for
Los Alamos National Laboratory

Author(s): Todd Haagenstad

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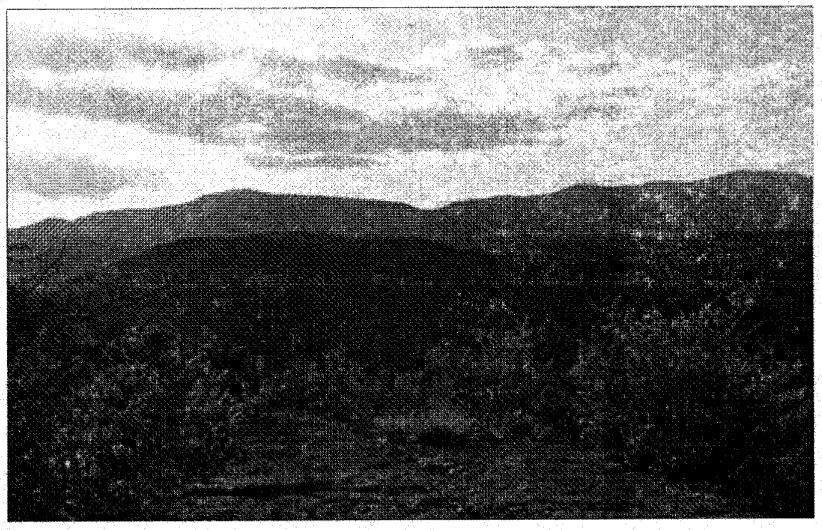
Los Alamos, NM 87545

Submitted to: US Department of Energy
Oak Ridge Operations Office
June 5, 1998



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Los Alamos, New Mexico 87545

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1.0 INTRODUCTION

This Preliminary Environmental Information Document (PEID) has been prepared and submitted by the Ecology group (ESH-20) at Los Alamos National Laboratory (LANL) as closure of a task performed in response to a request from the Department of Energy (DOE) Oak Ridge Operations Office in Oak Ridge, Tennessee. The DOE Oak Ridge Operations Office asked LANL to provide technical support in preparing an Environmental Impact Statement (EIS) for the proposed Spallation Neutron Source (SNS) facility. Through a mutual agreement with the DOE Oak Ridge Operations Office, ESH-20 has provided this PEID as closure on this task; no additional site assessment, analysis, or documentation is required.

In the SNS EIS, DOE's "preferred alternative" is to construct and operate the SNS facility at Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. DOE has also completed a process that identified suitable alternatives to the preferred alternative, and LANL was subsequently selected as one of three alternative sites. In support of this process, LANL conducted a siting study that analyzed the feasibility of constructing and operating the SNS facility at one of four different locations within LANL. Of the four potential locations, LANL has recommended analyzing a remote site located in the southeastern region of the reservation within Technical Area 70 (TA-70). The site evaluation process considered the following information in implementing the steps used to select one recommended LANL site:

- A list of the SNS facility physical design parameters
- The inventory of candidate LANL sites based on attributes and constraints
- Determination of the candidate site with the best attributes and least restrictions to accommodate the SNS facility

The information presented in this PEID is designed to provide preliminary information regarding the affected environment descriptions for the LANL alternative portion of the SNS facility EIS. This PEID presents current and existing preliminary environmental information regarding the LANL region, LANL, and the proposed SNS facility site at TA-70. Information regarding threatened or endangered species, wetlands, and cultural resources is based on recent surveys and site assessments. The individual sections of the document are intended to provide preliminary information that addresses resource topics identified as important in developing the SNS facility EIS.

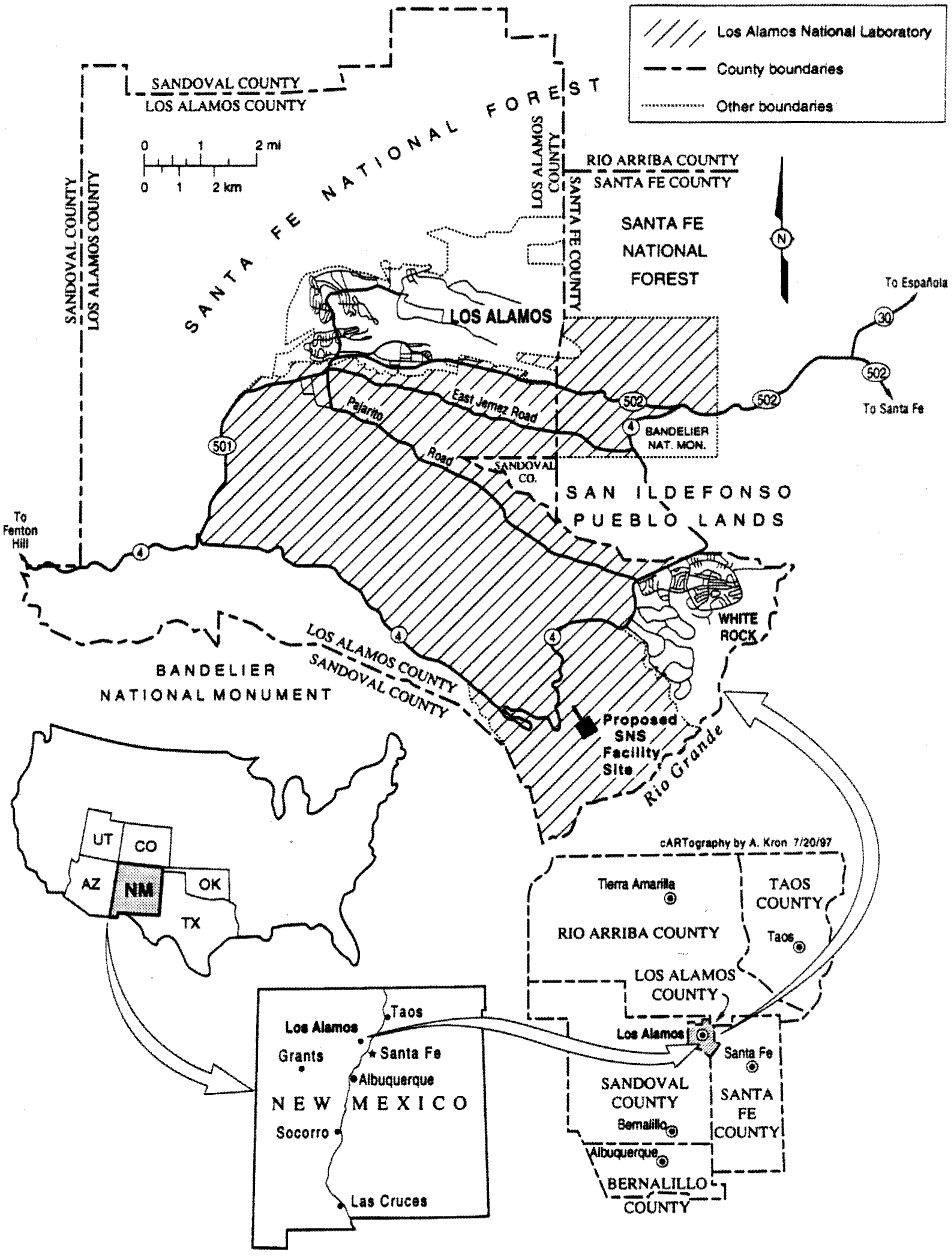
2.0 GENERAL SITE DESCRIPTION

LANL is a government-owned, contractor-operated multidisciplinary research facility that is located on 43 mi^2 (111 km^2) of land in north-central New Mexico approximately 60 mi (100 km) north of Albuquerque. It comprises a significant portion of Los Alamos County and extends into Santa Fe County (Figure 2-1).

Commercial and residential development in Los Alamos County is confined primarily to several mesa tops lying north of the core LANL facility, in the case of the Townsite, or southeast, in the case of White Rock and Pajarito Acres communities. The lands surrounding the Los Alamos County are largely undeveloped wooded areas with large tracts located to the north, west, and south of LANL administered by the U.S. Forest Service (Santa Fe National Forest), the National Park Service (Bandelier National Monument), and the Bureau of Land Management (to the east). The San Ildefonso Pueblo borders LANL to the east. The industrially developed acreage at LANL consists of approximately 30 active Technical Areas (TAs).

Recreational resources such as hiking trails, parks, and athletic facilities are abundant in Los Alamos County. Recreational opportunities such as camping, fishing, and hunting (U. S. Forest

Figure 2-1: Regional location of Los Alamos National Laboratory



Service lands) are available on the surrounding Federal lands. In 1976, the US Energy Research and Development Administration designated LANL as a National Environmental Research Park (NERP), which is used by the national scientific community as an outdoor laboratory to study the impacts of human activities on the Southwest woodland ecosystems existing at the site.

Four publicly accessible vehicle routes convey traffic to and from LANL (Figure 2-2). State Road 502 (Main Hill Road) is heavily used by commuter traffic from Santa Fe and Española. State Roads 4 and 501 provide access to LANL for small communities to the west of LANL. East Jemez Road and Pajarito Road are DOE owned and provide public access to many of the TAs at LANL. In addition to private vehicles, DOE and LANL employee and government vehicles contribute extensively to the volume of traffic on each of these roadways.

The proposed SNS facility site is located within TA-70 in the southeastern region of LANL (Figure 2-2). This is a remote and undeveloped area of LANL, situated less than 0.22 mi (.35 km) east of State Road 4. The area is situated at an elevation of approximately 6,445 ft (1,965 m) and located within a piñon-juniper woodlands with scattered juniper savannas. The mesa top is bordered by an unnamed canyon to the north, Ancho Canyon to the south, and White Rock Canyon and the Rio Grande to the east. The mesa top is unfenced and open to the public for recreational hiking and sight-seeing.

3.0 ENVIRONMENTAL FEATURES AND RESOURCES

This section of the PEID describes important environmental features and resources within the LANL region and proposed SNS facility site. The features and resources described in this section have been identified as important in developing the preliminary LANL-specific discussion in the SNS facility EIS.

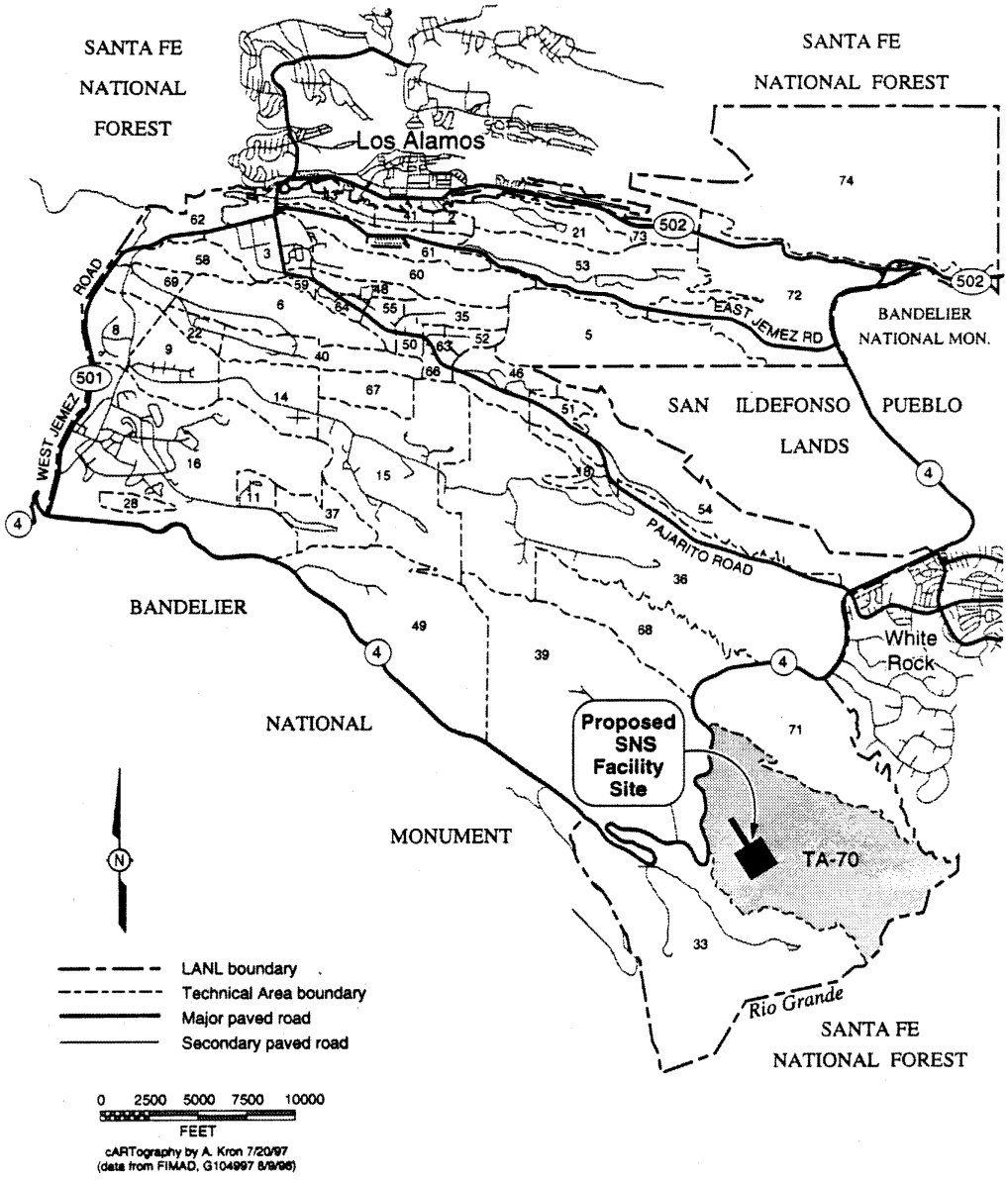
3.1 Land Use

Approximately 88 percent of the land in Los Alamos County is owned by the Federal government, including holdings controlled by DOE, the Department of Agriculture (Santa Fe National Forest), and the Department of the Interior (Bandelier National Monument). About 12 percent of the land in Los Alamos County is in private or local government ownership. Most of the private land has been developed and is a mix of residential, commercial, and industrial uses.

The majority of land within the LANL boundary has been designated as an environmental research and buffer zone. The next largest land use designation has been reserved for high explosives research and development and testing. The remaining areas of LANL are designated for use in experimental science, special nuclear materials research and development, physical support and infrastructure, waste management, and administrative and technical services.

Currently, the proposed SNS facility site is used as an environmental research and buffer zone for LANL operations. This site is remote, unoccupied, and mostly undeveloped except for an existing 115-kV electrical transmission line. Although land use policy and planning is under consideration at LANL, according to the 1990 LANL Site Development Plan, the existing land use is designated as "an undeveloped buffer area...reserved for future large-scale experimental science." The area surrounding the proposed SNS facility site has likewise been designated as an "environmental research/buffer" (LANL 1990). The proposed SNS facility site and the adjacent LANL buffer areas are not fenced. The site is open for use by the general public, and includes several unpaved paths and trails used for recreational hiking.

Figure 2-2: Location of the proposed SNS facility at Los Alamos National Laboratory



3.2 Visual Resources

The LANL region includes spectacular scenery. The orientation and geographic features of the Pajarito Plateau provide a dramatic circular view of landscapes ranging from arid desert grasslands to alpine and subalpine mountains. Looking southward from most locations at LANL, one can see the Sandia Mountains near Albuquerque, and the upper Rio Grande Valley and the Sangre de Cristo Mountains can be seen eastward and northward. The Jemez Mountains can be viewed directly west of the Pajarito Plateau. The elevation gradient from the Rio Grande to the Jemez Mountains is 12 mi (20 km), and the Pajarito Plateau is composed of a series of finger-like mesas separated by deep canyons running east to west from the Jemez Mountains towards the Rio Grande. This dramatic variation creates fascinating landscape features and supports many biologically diverse ecosystems.

The proposed SNS facility site is currently a remote and undisturbed piñon-juniper woodlands. The site is visible from State Road 4 traveling from Bandelier National Monument toward White Rock. The site is not visible from White Rock or from popular recreational use areas within Bandelier National Monument. Further visual resources analyses would be required to determine the visibility of the site from other potentially sensitive view sheds and locations within the region.

Based on a subjective assessment of the proposed SNS site, facility workers would have access to views of the Rio Grande valley and Sangre de Cristo Mountains to the northeast, east, and southeast, and could see the Jemez Mountains to the east. The Sandia Mountains near Albuquerque could be seen southward, and a mesa-top, piñon-juniper woodlands could be seen in the area surrounding the proposed SNS facility site.

3.3 Geology

3.3.1 Structure, Faults, and Fractures

The LANL site is located on the Pajarito Plateau, which is composed of very thick deposits of volcanic ash and ejected material collectively referred to as Bandeilier Tuff. On the Pajarito Plateau, the Bandelier Tuff consists of the Otowi and Tshirege members that were formed by cataclysmic eruptions from the Jemez Mountains 1.6 and 1.2 million years ago, respectively. This tuff includes ash fall, ash fall pumice, and rhyolite tuff, and ranges from welded to nonwelded. The tuff is more than 1000 ft (300 m) thick in the western part of the plateau near the Jemez Mountains, and thins to about 260 ft (80 m) at the eastern edge of the plateau above the Rio Grande.

Surface geology at the site proposed for the SNS facility is characteristic of the lower elevation mesa tops at LANL. The site has a gentile 20-degree slope from the northwest to the southeast towards White Rock Canyon and the Rio Grande. The surface of the mesa top is composed of bare tuff bedrock with interspersed areas of soil. The bedrock at this site is referred to as the Puye Formation; the specific depth of this formation at the proposed SNS site has not yet been determined.

There are two prominent canyons located adjacent to the site; Ancho Canyon, is located 0.27 mi (0.47 km) to the southwest, and an unnamed canyon is located 0.27 mi (0.47 km) to the northeast. The canyon slopes and bottoms adjacent to the site contain a variety of loose soils, cobble, and larger boulders from mass wasting of the canyon edges. The ground is considered stable at the site, and liquefaction and mass movement are generally not considered an issue.

3.3.2 Seismicity

The status and history of seismology within LANL and the surrounding region are the subject of ongoing and new investigations. Several prehistoric faults, running generally north and south along the base of the Jemez Mountains, transect the LANL site. The most prominent fault within this region is the Pajarito Fault. This fault and other regional faults are the subject of ongoing studies that are not yet conclusive. LANL researchers are in the process of updating a 1994 study that defined the extent and prehistoric activity of the regional faults. Final data regarding the history, frequency, magnitude, and probability of seismic activity at LANL are not yet available.

3.3.3 Soils

Large areas of soil are not common within the proposed SNS facility site. The majority of the site consists of exposed tuff bedrock with soils accumulated in low spots or along bedrock outcrops. Surface deposits on the mesa top include locally derived soils and, in places, a thin cover of fine-grained eolian sediment. The soil that does occur on the site has been identified as a Hackroy sandy loam. Based on current knowledge of soils at LANL, there are no prime farmlands within or directly adjacent to the proposed SNS facility site.

3.4 Climate

3.4.1 General Climate

The LANL region has a temperate, semiarid mountain climate that is strongly influenced by elevation and topography. The Pajarito Plateau has four distinct seasons. Precipitation occurs primarily during the summer and winter seasons. Los Alamos County has a semiarid, temperate mountain climate. This climate is characterized by seasonal, variable rainfall with precipitation rates ranging from 10 to 20 in. (25 to 51 cm) per year. Average minimum and maximum temperatures, based on 19- and 15-year means for the community of Los Alamos, have dropped as low as -18 F (-28 C) and have reached as high as 95 F (35 C). The average mean annual precipitation rate for Los Alamos from 1961 to 1990 was approximately 19 in. (48 cm).

3.4.2 Severe Weather

Thunderstorms are common at LANL, with 61 occurring in an average year. A thunderstorm day is defined as a day in which either a thunderstorm occurs or thunder is heard nearby. Most thunderstorm days occur during July and August, the so-called monsoon season. During this time of year, large-scale southerly and southeasterly winds bring moist air into New Mexico from the Gulf of Mexico and the Pacific Ocean. The combination of moist air, strong sunshine, and warm surface temperatures encourages the formation of afternoon and evening thundershowers, especially over the Jemez Mountains. No tornadoes have been reported to touch down in Los Alamos County.

Lightning in LANL can be frequent and intense during some thunderstorms. Because lightning can cause occasional brief power outages, lightning protection is an important design factor for most facilities at LANL and the surrounding area.

Hail is also very common at LANL during the so-called monsoon season. In fact, the area around Los Alamos has the most frequent hailstorms in New Mexico. Typically, the hailstones have diameters of about 0.25 in. (0.6 cm), with a few somewhat larger. Some storms produce measurable accumulations on the ground. Rarely, hailstorms cause significant damage to property and plants.

Large-scale flooding is not common in New Mexico. However, flash floods from heavy thunderstorms are possible in susceptible areas, such as arroyos, canyons, and low spots. Severe flooding has never been observed in Los Alamos. Light-to-moderate flooding is possible in the spring from snowmelt, although snowmelt flooding is usually confined to the larger rivers in New Mexico.

3.5 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air. The Environmental Protection Agency (EPA) has identified six criteria pollutants: carbon monoxide, lead, ozone, sulfur dioxide, nitrogen oxides, and particulate matter. The presence of forests and irregular and complex terrain in the Los Alamos area affects atmospheric dispersion of pollutants. The terrain and forests create an aerodynamically rough surface, forcing increased horizontal and vertical turbulence and other dispersion. The dispersion generally decreases at lower elevations where the terrain becomes smoother and less vegetated. The canyons surrounding LANL channel the airflow, which also limits dispersion. The frequent clear skies and light winds typical of the summer season cause daytime vertical air dispersion.

Los Alamos County, LANL, and the proposed SNS facility site are remote from major metropolitan areas and major sources of pollution. Air quality is better than ambient air quality standards set by EPA and the New Mexico Environment Department (NMED). All radioactive and nonradioactive air emissions are in compliance with the Clean Air Act and the New Mexico Air Quality Control Act (LANL 1996a).

LANL is subject to regulation under the following Federal and State air quality statutory requirements: National Emissions Standards for Hazardous Air Pollutants (NESHAP); National Ambient Air Quality Standards; New Source Performance Standards; Stratospheric Ozone Protection (SOP); and Operating Permit Program. All of these regulations, with the exception of radionuclide NESHAP and SOP, have been adopted by the State of New Mexico as part of a State Implementation Plan. The State of New Mexico Environmental Improvement Bureau, as provided by the New Mexico Air Quality Control Act, regulates air quality through a series of air quality control regulations in the New Mexico Administrative Code. These regulations are administered by NMED and define a series of permits that are issued for specific LANL operations.

3.6 Surface Water Resources

Surface water in the LANL area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into upper reaches of some canyons, but the volume is insufficient to maintain a constant surface flow across the entire length of LANL before being depleted by evaporation, transpiration, and infiltration. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some of the major canyon system drainages within LANL. Effluents from sanitary sewage, industrial waste treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

There are no permanent surface water resources within 0.25 mi (0.44 km) of the proposed SNS facility site. The drainages in Ancho Canyon and the unnamed canyon are classified as intermittent riverine wetlands by the US Fish and Wildlife Services' National Wetlands Inventory. These dry and sandy drainages (arroyos) occasionally contain water after snowmelt or heavy rainstorm events. Riparian vegetation is supported in some portions of these arroyos.

Although a formal floodplain assessment has not been completed for the proposed SNS facility at LANL, the proposed SNS site does not appear to be within a 50- or 100-year floodplain.

3.7 Groundwater Resources

Groundwater in the LANL area occurs in three modes: (1) water in shallow alluvium in canyons, (2) perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the main aquifer of the LANL area. Perched groundwater may occur within the Bandelier Tuff in the western portion of LANL just east of the Jemez Mountains. The source of this perched groundwater may be infiltration from streams discharging from the mouths of canyons along the mountain front and underflow of recharge from the Jemez Mountains. The main aquifer within the LANL area serves as the Los Alamos County municipal water source. Depth to the main aquifer is about 1,000 ft (300 m) beneath the mesa top in the central portion of the Pajarito Plateau. At this location, the main aquifer is separated from alluvial and perched waters by about 350 to 620 ft (110 to 190 m) of tuff and volcanic sediments with low (less than 10 percent) moisture content.

The main aquifer below the Pajarito Plateau has not officially been designated as a sole-source aquifer (class 1). However, according to specifications within the Clean Water Act, the aquifer meets all of the criteria for a sole-source aquifer. The aquifer is currently designated as a class 2 aquifer or high-quality drinking water.

LANL has not conducted a depth to groundwater assessment at the proposed SNS facility site; however, a groundwater monitoring well located directly adjacent and parallel to TA-70 indicates that the depth to the main aquifer is approximately 840 ft (257 m). The depth to groundwater at the bottom of Ancho Canyon along the southern edge of TA-70 is 600 ft (184 m).

LANL has conducted groundwater monitoring annually for several years as part of a groundwater protection program. Results of groundwater monitoring are reported annually in LANL's Environmental Surveillance Report. LANL has recently developed, and is in the early stages of implementing, a new site-wide groundwater monitoring program. The program will involve the installation of several new, strategically located, groundwater monitoring wells.

3.8 Ecological Resources

3.8.1 Terrestrial

The proposed project area and its surroundings are located on the Pajarito Plateau on the east-central edge of the Jemez Mountains. The plateau is composed of layers of volcanic sedimentary rocks, and is dissected into a number of narrow mesas by southeast-trending canyons. Most of these canyons support intermittently flowing streams. The stream drainages ultimately descend into White Rock Canyon and converge with the Rio Grande near the eastern boundary of LANL. The Rio Grande is the only permanently flowing river near the project area.

Three major vegetation zones have been identified within the boundaries of LANL; juniper savannas at the lowest elevations in White Rock Canyon, piñon-juniper woodlands at intermediate elevations on the mesas, and ponderosa pine forests at higher elevations on the mesas. Mixed-conifer forests also occur on the north-facing slopes of some canyons. Riparian zones occur in many of the drainages and along the Rio Grande. Wetlands of varying sizes also occur throughout LANL, particularly in the canyons.

LANL evaluated landscapes within a 0.25-mi (0.44-km) radius of the proposed project site, using a Geographic Information System (GIS) and site surveys. The preferred site is located on a mesa flanked by Ancho Canyon 0.27 mi (0.47 km) to the southwest and a small unnamed drainage an equal distance to the northeast. To the southeast, the Rio Grande flows through nearby White Rock Canyon, at a distance of approximately 1.2 mi (1.9 km) from the preferred site. The site is located 0.22 mi (0.35 km) to the east of State Road 4; a two-lane paved road

(see Figure 2-1). Elevations within the proposed project area range from 6,410 ft (1,954 m) to 6,490 ft (1,978 m).

The vegetation in the proposed project area is dominated by piñon-juniper woodlands, with scattered juniper savannas. Additionally, much of the land in and bordering the adjacent canyons is bare rock. Overstory plant species include piñon (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*). Scattered grasses, primarily blue grama (*Bouteloua gracilis*), shrubs, and forbs are found in the understories. In sites where bedrock is near the soil surface, the most common shrubs include wavy-leaf oak (*Quercus undulata*), hedgehog prickly pear (*Opuntia erinacea*), and sticky rabbitbrush (*Chrysothamnus viscidiflorus*). In areas with deeper soils, big sagebrush (*Artemisia tridentata*) is common. Forbs on both deep and shallow soils include greenthread (*Thelesperma trifidum*), golden aster (*Chrysopsis villosa*), thelypody (*Thelypodium wrightii*), and trailing fleabane (*Erigeron flagellaris*).

3.8.2 Unique or Rare Communities

No unique or rare biological communities have been identified within LANL or within the proposed SNS facility project area.

3.8.3 Wildlife

Lists of species found to be occurring in the proposed project area are located in Foxx (1996). Rocky Mountain elk (*Cervus elaphus nelsoni)* use piñon-juniper woodlands for wintering habitat and some year-round use. Mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), grey fox (*Urocyon cinereoargenteus*), rock squirrel (*Spermophilus variegateus*), and desert cottontail (*Sylvilagus auduboni*) are common mammals. Common bird species include common raven (*Corvus corax*), scrub jay (*Aphelocoma coerulescens*), piñon jay (*Gymnorhinus cyanocephalus*), plain titmouse (*Parus inornatus*), and ash-throated flycatcher (*Myiarchus cinerascens*).

3.8.4 Special Uses and Designations

In 1976 when LANL was identified as Los Alamos Scientific Laboratory, the DOE designated the site a NERP. LANL remains a NERP site. The preferred site is currently open to the public for some recreational non-motorized uses, including hiking and picnicking.

3.8.5 Aquatic Biota

The canyons adjacent to TA-70 and the proposed SNS facility site contain some surface water. Lists of aquatic biota found within the general area can be found in Foxx (1996). There are no aquatic areas within 0.25 mi (0.44 km) of the proposed project site. Lists of aquatic biota within the general area can be found in Foxx (1996).

3.8.6 Research and Monitoring

Current monitoring programs at LANL include local and regional surveys of air quality and surface and groundwater quality. These projects at LANL involve monitoring for radionuclides and contaminants in soil, flora, and fauna, as well as estimating potential human dose exposures to radioactivity. Annual surveys are conducted for breeding birds and all threatened or endangered species that may occur on the Laboratory (LANL 1996a). Previous floristic surveys have been conducted near the proposed project site. In 1991, a biological assessment that included the proposed project area was initiated. This study was completed in 1996 (Foxx 1996).

3.9 Wetlands

The drainages in Ancho Canyon, 0.27 mi (0.47 km) to the southwest, and in an unnamed canyon, 0.27 mi (0.47 km) to the northeast, of the project area are classified as intermittent riverine wetlands by the National Wetlands Inventory. These dry and sandy drainages (arroyos) occasionally contain water after snowmelt or heavy rainstorm events. Riparian vegetation is supported in some portions of these arroyos.

3.10 Threatened and Endangered Species

Potential threatened and endangered species at LANL are listed in Table 3-1. The habitat within the proposed project area is unsuitable for Mexican spotted owl (*Strix occidentalis lucida*), black-footed ferret (*Mustela nigripes*), and southwestern willow flycatcher (*Empidonax traillii extimus*). Therefore, these species were dismissed from consideration. The proposed project area includes foraging habitat for American peregrine falcon (*Falco peregrinus anatum*) and foraging and roosting habitat for bald eagle (*Haliaeetus leucocephalus*). Previous survey results indicate that the area surrounding the preferred site is unlikely to receive concentrated use from peregrine falcons for foraging, and that nesting habitat was marginal. The nearest identified peregrine falcon nesting habitat is in White Rock Canyon, approximately 1.2 mi (1.9 km) from the preferred site. Wintering bald eagles forage and roost within White Rock Canyon and connecting canyons, including Ancho Canyon. Additionally, bald eagles, whooping cranes (*Grus americana*), American peregrine falcon (*Falco peregrinus anatum*), and Arctic peregrine falcon (*Falco peregrinus tundrius*) may use White Rock Canyon as a migration route.

Table 3-1: Threatened and Endangered Species Potentially Occurring on LANL

Species	Scientific Name	Habitat Associations
American peregrine falcon	*Falco peregrinus anatum*	Nests on cliff faces. Forages in all habitat types within LANL.
Whooping crane	*Grus americana*	Migrates along Rio Grande in White Rock Canyon.
Southwestern willow flycatcher	*Empidonax traillii extimus*	Inhabits riparian areas with established willow stands.
Black-footed ferret	*Mustela nigripes*	Inhabits established prairie dog towns.
Arctic peregrine falcon	*Falco peregrinus tundrius*	Potentially migrates along the Rio Grande in White Rock Canyon.
Bald eagle	*Haliaeetus leucocephalus*	Inhabits riparian areas along permanent water ways such as lakes and rivers.
Mexican spotted owl	*Strix occidentalis lucida*	Inhabits multistoried mixed conifer and ponderosa pine forests.

3.11 Cultural Resources

3.11.1 Background

Los Alamos County, including LANL, is rich in cultural resources that include archeological sites, historic buildings and sites, and Traditional Cultural Properties (TCPs). As required under Executive Order 13007, the four Accord Pueblos with whom DOE has formal agreements (Cochiti, Jemez, Santa Clara, and San Ildefonso) and the Mescalero Apache, have been asked to identify any sacred or TCP issues that may apply to various locations throughout LANL. The TCP data are considered extremely sensitive data, and are under the control of the DOE Albuquerque Field Office in Albuquerque, New Mexico.

For the purpose of cultural resources assessment in this PEID, a "site" is defined as a location where a significant human activity has occurred. The visible indications of such behavior may include (but not be limited to) bedrock mortars, game traps, petrogyiphs, steps and roads, water-catching devices as well as habitations, terraces, shrines, and artifact scatters. For an artifact scatter to be defined as a site, the artifacts present must be indicative of purposeful human use of the area, that is, they must be present in either variety, quantity, or integrity of location to show that the area in which they are located is a loci of cultural activity. In general, all artifact scatters are considered as sites unless they, by their topographical situation, have obviously been transported by natural environmental forces away from clearly defined sites. Artifact scatters that are associated with clearly defined sites will be included in descriptions of the parent site. Artifacts located during survey, which do not meet these criteria, have been noted and described as isolated occurrences (IOs). For example, lone projectile points, artifacts washed downslope from obvious nearby sites and pot drops (potsherds obviously derived from the same vessel) have not been recorded as sites but as IOs. The area of potential effect (APE) for the SNS project contains numerous IOs, mostly lithic debris collecting in shallow drainages. These were not recorded as separate sites and are likely to be the result of moderate to severe erosion in the APE as well as a diffuse prehistoric use of the area.

3.11.2 Survey Results

Approximately 65 percent of the proposed SNS facility site, or APE, was surveyed for cultural resources. The total APE was estimated to be 70 ac (28 ha), including a 100-ft (30.5-m) buffer area around the project. The survey was accomplished by linear pedestrian transects spaced 16-33 ft (5-10 m) apart. All cultural features were noted and entered into a computerized database and GIS. A total of 5 archaeological sites were found in the 70 acres surveyed. The site number, site type, size, cultural affiliation, and National Register eligibility, are found in Table 3-2.

Table 3-2: Cultural Resource Assessment Survey Results

Laboratory of Anthropology Site Number	Field Site Number	Site Type	Site Size	Time Period	National Register Eligibility
LA12676-B	Parp-34	Field House	1-2 rooms	Coalition	Yes Criterion D
LA12676-C	Parp-33/L-153	Pueblo	8-10 rooms	Early Coalition	Yes Criterion D
(not assigned)	L-154	Pueblo	2-4 rooms	Classic	Yes Criterion D
LA6786	LA6786	Pueblo	6-8 rooms	Early Coalition	Yes Criterion D
(not assigned)	L-155	Field House	1 room	Classic	Yes Criterion D

3.12 Socioeconomic Environment

3.12.1 General Description

A socioeconomic assessment focuses on the social, economic, and demographic characteristics of an area. The socioeconomic environment can be affected by changes in employment, income, and population, which, in turn, can affect area resources such as housing, community services, and infrastructure.

Preliminary figures for 1995 indicated that Los Alamos County had an estimated population of 18,604 (Sunwest 1996, preliminary figure for 1995). Statistics for population, housing, and public infrastructure are based on the region of influence (ROI), a three-county area in which approximately 90 percent of LANL employees reside. This figure includes University of California, Johnson Controls, Inc., and Protection Technology of Los Alamos employees only; residence and employment figures do not include contract labor, affiliates, or special program guests. The ROI includes the counties of Los Alamos (with 50.4 percent of LANL employees), Rio Arriba (21.0 percent), and Santa Fe (18.3 percent) (LANL 1997). The ROI experienced a population growth of approximately 13.6 percent between 1990 and 1995, with a 1995 total population of about 172,000 persons (Sunwest 1996). Preliminary estimates indicate that by the year 2000, population in the ROI is expected to be approximately 195,000 persons (projection is based on figures in Sunwest 1996).

In January 1996, LANL employed approximately 8,936 persons in the ROI accounting for 10.4 percent of the total ROI employment (85,721) (LANL 1996b and Sunwest 1996). Nonagricultural employment in New Mexico increased by 4.9 percent in 1995; Los Alamos and Santa Fe counties had a 2.9 percent increase. Unemployment in the ROI for 1995 was 5.76 percent (Sunwest 1996). Information regarding employment status within the ROI for 1995-1997 is not available at this time.

3.12.2 Housing

The number of vacant housing units in the ROI increased from approximately 4,358 units in 1980 to 6,872 units in 1990, a 58 percent increase in ten years (BER 1992). In the year 2000 there would be about 10,858 total vacant units if current trends continue, however, more current figures are not available at this time.

3.12.3 Public Services

Los Alamos County is responsible for residential and commercial distribution of gas, water, electricity, and sewer services to the community on the north side of Los Alamos Canyon Bridge. DOE currently owns and operates all utilities on the south side of Los Alamos Canyon Bridge on LANL property. DOE also owns and operates the Los Alamos County-wide water production and distribution system. Transfer or lease of the water production system to Los Alamos County is being contemplated. The utilities usage and capacity are presented in Table 3-3.

In 1985, DOE and Los Alamos County agreed to pool their electrical generating and transmission resources and to share costs based on usage. Electrical power sources for the Los Alamos Resource Pool include a number of coal, natural gas, and hydroelectric power generators throughout the western United States. As needed, power can also be generated locally at LANL's TA-3 power plant that has an approximately 9- to 12-MW maximum output. Although power generation at the various sources is not a problem, regional and contractual electrical power transmission limitations have affected the amount of power available for DOE, LANL, and Los Alamos County.

Preliminary estimates indicate that approximately 3,550 students are enrolled in Los Alamos public schools (19 percent of Los Alamos County's population) (LAPS 1997). The ratio of

uniformed police officers to residents is currently 1 to 581 (LAPD 1997). The ratio of uniformed firemen to residents is 1 to 177.

Most of the revenue (approximately 73.6 million dollars) generated by Los Alamos County in fiscal year 1996 (June 1995 through July 1996) can be broken down as follows: 53 percent from utilities, 15 percent from gross receipts tax, 11 percent from the DOE fire contract, 7 percent from investment income, 4 percent from DOE assistance payments, and 4 percent from property taxes. The remaining revenue comes from other taxes, other service charges, and other intergovernmental sources (LA Finance Department 1997).

In October 1996, the President signed the Energy and Water Development Appropriations Act of 1997 authorizing a lump sum payment to Los Alamos County of about 22.6 million dollars. This payment is a buyout of DOE assistance payments in compliance with the Atomic Energy Commission Act. The last monthly assistance payment was made in June 1997. On April 15, 1997, Los Alamos County received the largest portion of the buyout money, 17.6 million dollars. The remaining 5 million dollars is subject to future transfers of DOE facilities to Los Alamos County, including the water system and the airport.

Table 3-3: Utilities: Usage and Capacity

Utilities	LANL	Los Alamos County
Electrical	peak Los Alamos Resource Pool usage per hour - 76 MW[c] (LANL metered usage – 366,158 MWh per year[a]) peak Los Alamos Resource Pool capacity - (maximum output per hour) - 104 to 119 MW	peak Los Alamos Resource Pool usage per hour - 76 MW[c] (County metered usage - 87,139 MWh per year[b]) peak Los Alamos Resource Pool capacity - (maximum output per hour) - 104 to 119 MW
Water	usage- 262,955,000 gallons per year[a] (*995,284,670 liters*) capacity- 1,406,058,000 gallons yearly production[a] (*5,321,929,500 liters*) [includes both the LANL and County water supply] (DOE water rights - 5,541.3 ac-ft/year* from main aquifer. DOE can buy an additional 1,200 ac-ft/year from San Juan-Chama Transmountain Diversion Project[d])	usage- 970,195,000 gallons per year[b] (*3,672,188,000 liters*) capacity- see LANL water capacity
Natural Gas	usage- 1,365,996 million Btu per year[a] capacity (contractual)- 10,000 million Btu per day or 3,650,000 million Btu per year[a]	usage- 1,059,420 million Btu per year[b] capacity (contractual)- 10,101 million Btu per day or 3,686,865 million Btu per year[e]

a Information from Jerome Gonzales, LANL FSS-8, personal communication, 4/16/97.

b Information from John Arrowsmith, Los Alamos County Utility Department, Final Sales Revenue Report: Electric, Gas, and Water (County FY96).

c Information from Mark Hinrichs, LANL FSS-8, personal communication, 5/9/97; FY 96 Los Alamos Resource Pool data (numbers reflect combined LANL and County peak usage per hour).

d Information from Timothy Glasco, Los Alamos County Utility Department, personal communication, 4/15/97, and Jerome Gonzales, LANL, FSS-8, personal communication, 4/23/97.

e Information from Los Alamos County's Utility Department for County FY96, Chris Ortega, personal communication, 4/15/97.

* 1,805,909,670 gallons per year or 6,835,368,100 liters per year

3.12.4 Transportation

Highways provide the primary access to LANL and the rest of Los Alamos County from the Rio Grande Valley, Santa Fe, and Albuquerque. Los Alamos has no bus or rail connections, but commuter air service is available between Los Alamos and Albuquerque. Slightly less than half of the employees at LANL commute from Santa Fe, Española, and other areas in the region.

Highway access to the Los Alamos County is by State Road 4 from the west and State Road 502 from the east. There are four main access points to LANL, which convey about 40,000 average daily trips (ADTs). They are Diamond Drive across the Los Alamos Canyon bridge (28,000 ADTs), Pajarito Road (8,000 ADTs), East Jemez Road (6,000 ADTs), and State Road 4/West Jemez Road from the west (1,000 ADTs).

The proposed SNS facility site can be accessed from State Road 4 via a primitive dirt road through a three-strand barbed wire fence with a locked gate. State Road 4 is used by LANL employees accessing experimental sites in the southern and southeastern reaches of LANL. The general public uses State Road 4 to access the Jemez Mountains, White Rock, and Bandelier National Monument. The traffic on the section of State Road 4 between White Rock and Bandelier National Monument is generally considered to be light, however, the road may receive slightly more use during the summer tourist season (May through September).

3.13 Ambient Noise

Noise is defined as unwanted sound. Sound is a form of energy that travels as invisible pressure vibrations in various media, such as air. The auditory system of the human ear is specialized to sense the sound vibrations. Noise is categorized into two types: *Steady-State Noise* which is characterized as longer duration and lower intensity such as a running motor and *Impulse or Impact Noise* which is characterized by short duration and high intensity such as the detonation of high explosives. The intensity of sound is measured in decibel (dB) units. In sound measurements relative to human auditory limits, the decibel scale is modified into an A-Weighted Frequency scale (dBA).

Noise measured at LANL is primarily from occupational exposures. These measurements take place inside buildings and are made using personal noise dosimeters and instruments. Occupational exposure data are compared against an established Occupational Exposure Limit (OEL). LANL defines the OEL administratively as noise to which a worker may be exposed for a specific work period without probable adverse effects on hearing acuity. The OEL for steady-state and impulse or impact noise at the Laboratory is based on U. S. Air Force Regulation 161-35, "Hazardous Noise Exposure," which has been adopted by DOE. The maximum permissible OEL for steady-state noise is 84 dBA for each 8-hour work period. The OEL for impulse/impact noise is not fixed because the number of impacts allowed per day would vary depending on the dBA of each impact. LANL Action Levels for steady-state noise and impulse/impact noise are 80 dBA for each 8-hour day and 140 dBA, respectively. The Action Levels trigger the implementation of a personnel hearing conservation program.

Environmental noise exposure is measured outside of buildings. The sound levels measured vary and are dependent on the generator. The following are typical examples of sound levels (dBA) generated by barking dogs (58), sport events (74), local cars (63), aircraft overhead (66), children playing (65), and birds chirping (54). LANL sources of environmental noise consist of background sound, vehicular traffic, routine operations, and periodic high-explosive testing. Measurements of environmental noise in and around LANL average around 80 dBA. Some measurements have been made to evaluate environmental impacts from operational and high-explosive detonation noise. For example, the peak noise level measured at one of LANL's explosives test facilities from a 20-lb (9-kg) trinitrotoluene (TNT) explosion ranged from 140 to 148 dBA at a distance of 750 ft (229 m).

The values from limited ambient environmental sampling in Los Alamos County are within the expected sound levels (55 dBA) for outdoors in residential areas. Background sound levels at the White Rock community ranged from 38 to 51 dBA (Burns 1995) and 31 to 35 dBA at the entrance of Bandelier National Monument (Vigil 1995). The minimum and maximum values for Los Alamos County in this study were 40 dBA and 96 dBA, respectively.

Ambient noise levels at the proposed SNS facility site have not been recorded. However, given the remoteness of the site and the distance from industrialized or populated areas, the ambient noise levels are generally considered low. Test shots conducted within the explosives testing areas west of the site may be vaguely heard on occasion.

3.14 Radiation Environment

The radiation environment at LANL and the surrounding communities is continuously monitored and characterized. These results are reported in annual LANL environmental surveillance reports (LANL 1996a). Air emissions are routinely sampled at locations on LANL property, along the DOE boundary perimeter, and in more distant areas that serve as regional background stations. Atmospheric concentrations of radioactive nuclides (radionuclides) are measured to estimate internal radiation doses. Thermoluminescent dosimeters are used to determine external penetrating radiation doses in the area. Background dose estimates are subtracted from the measured values to determine the effective dose equivalents (EDE) to the public outside the site boundary and at the nearest residence. The EDE is a term for the estimated radiation dose to the whole body that would result from a dose to any one or more body organs.

The radiation environment at LANL consists of both (1) natural background radiation and induced background levels of radioactivity in the surrounding communities and (2) the workers' radiation environment within their work areas. All individuals are subject to some irradiation although they may not work with radioactive substances. The annual average EDE from background and induced radiation for 1995 to nearby residents in Los Alamos and White Rock was 349 mrem and 336 mrem, respectively (LANL 1996a). The average EDE attributable to 1995 LANL operations was 0.5 mrem and 0.2 mrem for residents in Los Alamos and White Rock, respectively (LANL 1996a). The maximum annual dose to a potentially exposed member of the public from 1995 LANL operations is estimated to be approximately 2.3 mrem per yr. DOE's public dose limit is 100 mrem per yr EDE from all pathways, and the dose received through the air pathway is restricted by EPA's dose standard of 10 mrem per year. Table 3-4 summarizes the various estimated annual exposures to the public associated with LANL operations during 1995. The annual average EDE from background and induced radiation for the proposed SNS facility site has not been specifically calculated as part of this PEID.

Table 3-4: Summary of Annual Effective Dose Equivalents for 1995

Dose Source	Maximum Dose to an Individual[a,b]	Average Dose to Nearby Residents; Los Alamos and White Rock		Collective Dose to Population within 50 mi (80 km) of LANL[b]
Dose Attributable to LANL Operations	2.3 mrem	0.5 mrem	0.2 mrem	3.2 person-rem
Background Dose	349 mrem	349 mrem	336 mrem	82,000 person-rem

a Maximum dose to an individual is the dose to any individual at or outside LANL where the highest dose rate occurs (i.e., residence north of TA-53).

b Doses reported are average doses.

Source: (LANL 1996a)

3.15 Waste Management and Environmental Restoration

3.15.1 Waste Management

LANL and Los Alamos County have established procedures for maintaining compliance with applicable laws and regulations for collecting, storing, processing, and disposing of industrial and municipal solid waste. LANL's solid sanitary waste is disposed of at the Los Alamos County landfill, which is operated by Los Alamos County on DOE property within LANL. Preliminary estimates indicate that LANL disposes of an average of about 31,270 yd^3 (23,910 m^3) of solid waste annually at the County landfill (DOE 1996). Current preliminary estimates indicate that this landfill has an expected use life of about 15 more years. Trash from commercial companies in Los Alamos County is collected in County trucks on a regular, and special request, basis and disposed of at the County landfill. In 1996, about 20,000 yd^3 (15,300 m^3) of commercial trash was disposed of at the County landfill. Rubble from LANL, the County, contractors, and individuals is accepted at the County landfill. In 1996, 15,600 tons (14,200,000 kg) of rubble were disposed of at this location. Los Alamos County also maintains a separate location at the landfill for construction debris that is available for reuse by individuals or companies. In 1996, about 5,870 tons (5,340,000 kg) of construction debris were disposed of at the County landfill. Another location within the Los Alamos County landfill is used to process green waste such as tree limbs, brush, leaves, and grass. This material is shredded and some of it is composted on-site. The processed materials are available to the public, schools, County, and LANL for use as a ground cover or soil conditioner. About 13,200 yd^3 (10,100 m^3) of green waste was disposed of at the County landfill in 1996 (LAC 1996).

LANL operates a low-level waste disposal area at TA-54 for the management of radioactive wastes generated by LANL activities. There is no permitted treatment, storage, and disposal facility in New Mexico for radioactive waste generated by commercial companies, hospitals, and universities. Envirocare Inc., a facility in Utah, may accept radioactive waste from these types of generators.

Los Alamos County operates two sanitary wastewater treatment facilities, one in White Rock and one in Bayo Canyon. The latter sewage treatment plant processes the sewage from Los Alamos Townsite. Nearly all of the sanitary wastewater generated at LANL goes to the LANL Sanitary Wastewater Systems Consolidation (SWSC) plant at TA-46. Table 3-5 shows the preliminary estimates of volume of sewage processed each day at these three sewage treatment plants and the capacity of the three plants.

Table 3-5: Sanitary Sewer Usage and Capacity

Facility	Usage (gal per day)	Capacity (gal per day)	Usage (liters per day)	Capacity (liters per day)
Bayo Canyon Sewage Treatment Plant[a]	900,000	1,370,000	3,400,000	5,200,000
White Rock Sewage Treatment Plant[a]	500,000	820,000	1,900,000	3,100,000
LANL SWSC Plant[b]	400,000	600,000	1,350,000	2,300,000

a Information from Keith Schwertfeger, Los Alamos County Utility Department, telephone conversation with Ellen McGehee, Ecology Group, Los Alamos National Laboratory, April 15, 1997.

b Information from Ed Hoth, Utilities and Infrastructure Group, Los Alamos National Laboratory, telephone conversation with Ellen McGehee, Ecology Group, Los Alamos National Laboratory, April 16, 1997.

The Bayo Canyon sewage treatment plant is operating below capacity and could handle more sewage per day. There are, however, other constraints on the sanitary system as a whole, such as the size of existing pipes and the capabilities of existing lift stations.

The SWSC plant is operating below capacity as shown in Table 3-5. The sewage from different parts of TA-3 is collected and merged before it goes to the SWSC plant at TA-46. The size of these existing pipes limits the amount of sewage that can be handled from TA-3 and, as a result, the TA-3 portion of LANL's sewer system is operating close to capacity.

These sanitary waste treatment systems are all a considerable distance from the proposed SNS facility site. Further analysis and planning is required in order to establish the feasibility of using these systems in support of the operation of the proposed SNS facility.

3.15.2 Environmental Restoration

The Environmental Restoration (ER) Project at LANL is part of a national effort by DOE to clean up the facilities involved in its past or present weapons production program. The goal of this effort is to ensure that DOE's past operations do not threaten human or environmental health and safety. The ER Project is governed primarily by the RCRA, which addresses the day-to-day operations of hazardous waste management, treatment, storage, and disposal facilities; establishes a permitting system; and sets standards for all hazardous-waste-producing operations at these facilities. Under this law, LANL must have a permit to operate its facilities (LANL Permit is NM 0890010515). RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) in 1984, prescribes a specific corrective action process for all potentially contaminated sites. The ER Project is investigating all sites that may have been contaminated by past operations to determine the nature and extent of any contamination. It is also exploring possible measures for cleaning up contamination and selecting and implementing remedies at these sites.

DOE provides the broad definition of activities undertaken by the ER Project at LANL. Budgets, schedules, and many procedural requirements for the ER Project have been set by DOE. DOE is accountable to two regulatory agencies: The EPA, Region 6, and the NMED. As required by the HSWA Module of LANL's permit to operate under RCRA, the ER Project established a Records-Processing Facility as the repository for all its documentation. The facility collects, organizes, indexes, stores, and protects all relevant information for use by all ER Project participants and stakeholders, including DOE, EPA, NMED, and the public. The references cited in this section can be found at the Records-Processing Facility or the LANL Community Reading Room; both are in Los Alamos.

EPA has the primary responsibility for developing, promulgating, and enforcing regulations to implement RCRA and HSWA, although it may delegate, and has delegated all of its regulatory authority to NMED. Whenever there is a need to change information in the HSWA Module, LANL and DOE prepare a proposal to the regulators to modify the permit, such as a Class III modification to remove a potential release site (PRS) from the list in the HSWA Module and take no further clean-up action on the PRS. Before a PRS can be removed from the HSWA permit, a Class III permit modification must be proposed to the regulator. Other changes in the permit also require a Class III permit modification.

Solid Waste Management Units (SWMUs) are potentially contaminated sites that are listed in the HSWA Module of LANL's RCRA Operating Permit. In addition, there are other sites that have been identified as areas of concern but that are not in the HSWA Module. The general term for all potentially contaminated sites is potential release sites (PRSs).

If approved, the PRS is removed from further consideration by the ER Project. If not approved, the ER Project proposes further actions that may include characterization, a corrective measures study, a clean-up plan, an interim action, or a best management practice. No PRS is removed from the HSWA module until the regulators approve no further action. While it is expected that

construction would not occur within the lateral extent of a PRS still listed in the HSWA module, it is possible that any necessary remediation may be complicated by the presence of buildings or other infrastructure in the vicinity.

A LANL RCRA Facility Investigation conducted within and surrounding the proposed SNS facility site, determined that the site does not include any SWMUs or PRSs (LANL 1992).

4.0 Cumulative Impacts

This section considers a preliminary assessment of the potential sources of cumulative impacts resulting from the construction and operation of the proposed SNS facility, as well as other reasonably foreseeable future actions within and adjacent to the site. The sources of cumulative impacts on the environment result in the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Sources of cumulative impacts can be associated with individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Past activities within and directly adjacent to the proposed SNS facility site have been limited to use by the public for general recreational uses such as day hikes and sightseeing. For several decades the area has not open to public vehicular traffic, however, there are a few primitive access roads that have been used by Federal personnel for occasional access. Approximately 40 years ago, the federal agency now referred to as the DOE, constructed a single 115-kV electrical transmission line. A portion of this transmission line crosses what is now the proposed SNS facility site.

Current activities within and directly adjacent to the proposed SNS facility site are very limited. The site continues to be used by the public for general recreational uses such as day hikes and sightseeing. Public vehicular traffic remains restricted at the site. The activities associated with the maintenance and operation of the 115-kV electrical power transmission line are anticipated to remain unchanged from previous conditions. Non-Federal construction projects or other similar activities are not expected to occur at the site under the current DOE ownership.

The only reasonably foreseeable DOE action at the proposed SNS facility site is the proposed construction and operation of a 345 kV-designed electrical power transmission line that would parallel the existing 115-kV transmission line that currently transects the proposed site. Although this proposed transmission line would be a 345 kV-designed system, it would be operated at 115 kV within the reasonably foreseeable future. Although the DOE is preparing an Environmental Impact Statement that considers an action to transfer selected parcels of LANL land to local Native American Indian tribes and Los Alamos County, the proposed SNS facility site is not within a parcel being considered for transfer.

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5.0 References

BER 1992: The Bureau of Business and Economic Research, University of New Mexico, "The Census in New Mexico, Population and Housing Characteristics for the State and Counties from 1980 and 1990 Census," University of New Mexico (January 1992).

Burns 1995: M. J. Burns, "White Rock Noise Measurements during PHERMEX Tests, 11 March 1995," Los Alamos National Laboratory memorandum No. DX-DO:DARHT-95-31 (March 13, 1995).

DOE 1996: U.S. Department of Energy, "Environmental Assessment for the Low Energy Demonstration Accelerator, Technical Area 53," U.S. Department of Energy report DOE/EA 1147 (April 1996).

Foxx 1996: Foxx, T. S. 1996. "Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1122, TA-33 and TA-70," Los Alamos National Laboratory report LA-UR-93-106, Los Alamos, New Mexico (1996).

LAC 1996: Los Alamos County Landfill Weight Records for 1996, Review of Records.

LA Finance Department 1997: Los Alamos County Finance Department, "County of Los Alamos Summary of Revenues Year Ended 30 Jun 1996," information provided by Tim Bell (April 1997).

LANL 1997: Los Alamos National Laboratory, "Data Profile, January 1997," Community Involvement and Outreach Office document (1997).

LANL 1996a: "Environmental Surveillance at Los Alamos During 1995," Los Alamos National Laboratory report LA-13210-ENV (1996).

LANL 1996b: Los Alamos National Laboratory, "Data Profile, January 1996," Community Involvement and Outreach Office document (1996).

LANL 1992: Los Alamos National Laboratory, "RFI Work Plan for Operable Unit 1122," Los Alamos National Laboratory report LA-UR-92-925 (1992).

LANL 1990: "Los Alamos National Laboratory Site Development Plan – Technical Information, Facilities Engineering Planning Group," Los Alamos National Laboratory controlled publication LA-CP-90-405 (1990).

LAPD 1997: Los Alamos Police Department, Captain Horton, personal communication to Ellen McGehee (April 18, 1997).

LAPS 1997: Los Alamos Public Schools Administration Office, Cheryl Pongrantz, personal communication to Ellen McGehee (April 18, 1997).

Sunwest 1996: Sunwest Bank "Economic Review, 1995," Boatmen's Sunwest, Inc., Albuquerque, New Mexico (1996).

Vigil 1995: E. A. Vigil, "Noise Measurement at State Road 4 and Bandelier Turn-Off at State Road 4 during PHERMEX Test on March 11, 1995," Los Alamos National Laboratory memorandum No. ESH-5:95-11825 (March 17, 1995).

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NSNS SITE SURVEY

BIOLOGICAL ASSESSMENT

The proposed site for the National Spallation Neutron Source (NSNS) at Brookhaven National Laboratory was surveyed on January 5, 8, 10 and 13, 1998. The site (Attachment 1) was subdivided into Area A, the narrow portion, and Area B, the wider portion. The dimensions of the site are approximately 1,000 m x 500 m. Ten stations for detailed site inspections were established. Stations 1-4 were located in Area A while Stations 5-10 were located in Area B. In addition, the ~45 m buffer zone surrounding the site was surveyed. The study consisted of a visual inspection of the dominant vegetation types and a consideration of the possibility of the site harboring threatened and/or endangered species.

SITE DESCRIPTION

The site is located on the Ronkonkoma Moraine and consists of undulating morainal topography of relatively low relief with erratics present throughout. The elevation of the area is approximately 25 m with a total relief of ~9 m. The area of greatest relief is in the southernmost portion of the site. The site contains no areas of unusual geomorphology.

VEGETATIONAL COMMUNITIES

The southern portion of Area 1 (Stations 1-3) consists of a stand of white pine (*Pinus strobus*) apparently planted during the 1930s, most likely as a Civilian Conservation Corps project. Communities composed of planted white pine are common in Suffolk County.

Within this area, at Stations 1-3, are scattered self-sown pitch pine (*Pinus rigida*). The understory is sparse due to shade and pine needle litter, and consists of huckleberry (*Gaylussacia* sp.) with lesser amounts of blueberry (*Vaccinium* sp.). Occasional oaks (*Quercus* sp.) are found along the edges of the firebreaks and lanes in this area.

The white pines appear to have been planted only at Stations 1, 2, and a portion of Station 3. The remainder of Station 3 (approximately 50%) and all of Station 4 consists of a native oak-pine woodland.

There is evidence of extensive disturbance associated with operations at Camp Upton during the First World War. These disturbed areas include an extensive system of trenches, as well as a complex of deep pits and banks that are found within Area A and in the adjacent buffer zone. Mounded disturbed areas formed in the course of trenching operations are vegetated by large white pines. The fact that these areas were disturbed during WW I is

based on the presence of the white pine planted in the 1930s, which are presently overgrowing the trenches, pits, etc.

In the vicinity of the pits and banks (Station 1, Area A) there is an assemblage of species not found elsewhere in either Area A or B. These include the introduced ornamental shrubs, Japanese barberry (*Berberis thunbergii*) and jetbead (*Rhodotypos scandens*), as well as black locust (*Robinia pseudoacacia*). The native red maple (*Acer rubrum*), wild black cherry (*Prunus serotina*), and grape (*Vitis* sp.) are also present. The presence of these species may be due to the somewhat moister conditions within the deep pits.

In the more open areas along the firebreaks and lanes throughout Area A the vegetation primarily consists of broomsedge (*Schizachyrium* sp.), sedges (*Carex* spp.), including the Pennsylvania sedge (*C. pensylvanica*) and lichens (*Cladina* sp.).

The remainder of the entire area (Stations 5-10) is composed of either pine-oak or oak-pine communities. In the pine-oak community pitch pine may compose as much as 90% of the total, while in the oak-pine communities the oaks predominate. The only obvious recruitment of new individuals is along the edges of the firebreaks and lanes where pitch pine saplings are common.

The oaks inhabiting the entire site (Areas A and B) are predominantly scarlet oak (*Q. coccinea*) and white oak (*Q. alba*), with the scarlet oak the most common. The understory in Stations 5-10 is huckleberry and blueberry with occasional individuals of scrub oak (*Q. ilicifolia*) and, rarely, highbush blueberry (*V. corymbosum*).

The northwest portion of Station 9 approaches the wetlands associated with the headwaters of the Peconic River. The community structure in this section shifts abruptly from the upland vegetation of pitch pine, white and scarlet oak to a wetland vegetation of red maple, tupelo (*Nyssa sylvatica*), swamp azalea (*Rhododendron viscosum*) and sweet pepperbush (*Clethra alnifolia*). Widely dispersed, large individual pitch pine also occur in this area.

In severely disturbed portions of Area B, where the subsoils were exposed, monospecific stands of young pitch pines are found. In addition, a borrow pit approximately one hectare in area at Station 10 is exclusively occupied by a mature stand of pitch pines.

PROTECTED NATIVE PLANTS

Protected native plants in New York State are placed in four categories by the N.Y.S.D.E.C.: 1) Endangered, 2) Threatened, 3) Exploitably Vulnerable and 4) Rare.

No rare, endangered or threatened species were noted during this survey. The following exploitably vulnerable species were ob-

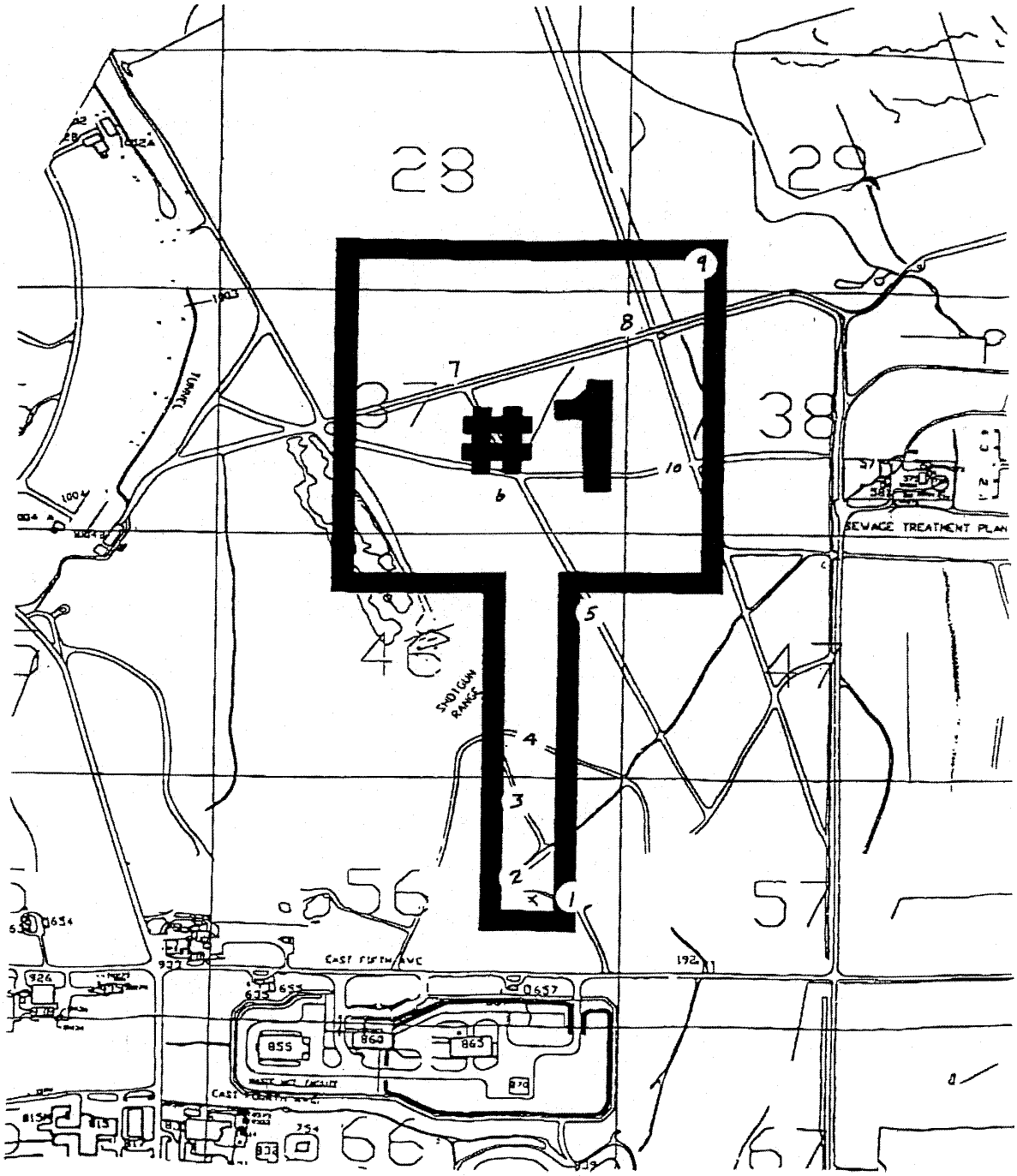
served on the site:

SPECIES	STATION
spotted wintergreen (*Chimaphila maculata*)*	4
bayberry (*Myrica pensylvanica*)*	6
swamp azalea (*Rhododendron viscosum*)*	9

*none of the above are uncommon on Long Island

The northwest portion of Station 9 approaches wetlands associated with the Peconic River. This area may be suitable habitat for the tiger salamander (*Ambystoma tigrinum tigrinum*) which is endangered in New York State, the spotted salamander (*A.maculatum*), a species of special concern, and the marbled salamander (*A. opacum*), the status of which is unknown in the state.

It is to be noted that this survey was conducted in mid-winter which prevents a complete evaluation of the possible presence of protected native plants on the site. However, all of the communities noted on the site proposed for the NSNS are common on Long Island.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